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ABSTRACT

In this study an effort was made to determine the effects upon learning of subclinical degrees of nutritional stress in an urban black ghetto. The study population index and control groups were selected from healthy babies born between 1964 and 1966 in Kansas City, Kansas. In the first part of the study, newborn anthropometric measurements and growth patterns of the two groups were compared to determine whether differences in body measurements were related to differential performance on psychological tests of mental development. In the possibly malnourished index group of children, current head circumference was found to be positively associated with performance on these tests. No such relationship was found for the control group, nor were statistically significant associations between any other anthropometric measures and psychological test performance identified. In the second part of the study, each child was considered in the context of his/her home environment. An attempt was made to identify factors associated with the child's assignment to the index or control group at birth, and with the child's nutritional environment and growth since birth. At the aggregate level of this sample, nutrition and growth were shown to be related. Differences in child growth were found to be associated with a number of environmental factors. Additional results of the study are presented in statistical form and are discussed in detail. (Author/GC)

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ED155296

Final Report

Project No.
Grant No. OEG-0-72-1383

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ENVIRONMENTAL INFLUENCES ON LEARNING BEHAVIOR IN AN URBAN AFRO-AMERICAN COMMUNITY.

November 15, 1974

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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Environmental Influences on Learning Behavior in an Urban Afro-American Community (NORTHEAST RESEARCH PROJECT)

Dr. Michael H. Crawford
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Miss Marcelline Fowler and the very helpful staff of Medical Records at KUMC cheerfully took on the extra work of showing us medical records of almost one thousand children, for which we are most appreciative.

Our deepest personal thanks are due to Mrs. Lolita White, Mrs. Eleanor Monroe, Mr. Edward C. Morgan and Miss Clara L. Bradford, without whom this study would never have been completed; and to Mrs. Dottie Newsom, Mrs. Donna Gray, Gina White, William Celester White, Dana Brown, Natalie Newsom, Marcus Newsom, Tiera Jackson and the children and parents who participated in the study, for the warmth and trust they extended to a stranger.

Introduction

Although few thoughts are more disturbing than the possibility that some children are not achieving their genetic potential for mental development due to an inadequate environment, as a research topic few subjects are more elusive. The multiplicity of factors which can be subsumed under the heading, "environment", and the difficulty of quantification, preclude a total profile. To the extent that there is a biological basis for this decrement (and there is little clear agreement here as well), the effect of many of these factors may be mediated by nutrition.

A focus on nutrition is timely. Information on it is developing from two directions: first, nutrition has recently been given formal recognition as of public health interest in the United States, through the so-called Ten-State Nutrition Survey (U.S. Dept. of Health, Education and Welfare, 1973), and the Health and Nutrition Examination Survey of the United States, 1971-72 (National Center for Health Statistics, 1974). Secondly, the medical and scientific literature is now replete with evidence of a relationship between early severe malnutrition and retarded mental development in experimental animals and man (see Birch, 1972 and Shneour, 1974 for an overview). Cravioto (et al., 1966) and Mönckeberg (1972) have found that, in cases where severe malnutrition was known to have affected the young human phenotype, anthropometric measurements correlated with levels of mental development, i.e. both were depressed. These studies provided the model for the present research, with the question directed to much milder, subclinical degrees of nutritional stress.

Our study population is very different from those of Cravioto and Mönckeberg: their work was carried out in areas of Latin America where protein malnutrition is endemic, while we have chosen an urban American ghetto, where the incidence of clinically identifiable child malnutrition has been low and has usually been associated with parental neglect. However, no one has established a minimal point for discernible effects of malnutrition on learning behavior, and we therefore believe the question was worth asking in an urban American poverty area, where children with learning problems are usually overrepresented.

The purpose of this study, therefore, was to focus on nutrition as a nexus of the biological, social, cultural and economic spheres of the environment in an urban American black community, and to relate variability in nutritional experience of children, and their mothers, to measureable sequelae, especially child growth and mental development. We attempted to partly compensate for the less dramatic level of malnutrition by adding refinements, mainly by taking into account newborn anthropometry, medical information on mother and child, and by gathering more data on the environment and nutritional experience of the study population.

There are several assumptions and limitations in the present study which should be mentioned at the outset. An assumption is made that, in the absence of any clinical explanation, low birthweight reflects intrauterine nutritional stress of some form in the newborns selected for the index group (sex and, as far as possible, parity and calculated gestational age, have been controlled for). One major limitation is that no data are available on the stage of physical maturation of children. Hand-wrist X-rays, which would have been desirable, were not practicable. However, head circumference, the anthropometric measurement which turned out to be of greatest interest in the final analysis, is less affected by this limitation than other measurements, due to the head's relatively early growth schedule (Lowrey, 1973: 71-72).

Finally, implicit in the research design is the assumption that nutrition is a key intervening variable between other environmental factors, and both somatic growth and mental development. Although many factors were taken into account, primary emphasis was placed on the acquisition, preparation and consumption of food.

It might appear that we controlled for "race" out of deference to those on the radical fringe of the nature-nurture controversy over the heritability of behavioral traits. In fact, the selection of an American black community as the study population had one clear advantage: one finds within a black community the tremendous environmental variability necessary for a study such as this, with many prosperous, well-educated and talented blacks, who could easily afford to live outside the ghetto, living in close proximity to the poor.

A purposive sample was selected from full-term, healthy black newborns born at the University of Kansas Medical Center in 1964, 1965 and 1966 to Kansas City, Kansas mothers residing in the Northeast area at that time. All newborns with evidence of clinical anomalies, or gestational or birth complications which could affect growth and/or development, were eliminated. The remaining children were assigned, on the basis of birthweight, to a "possibly malnourished" index group or a "normally nourished" pool from which the control group was selected, matched for sex and, so far as possible, parity and calculated gestational age (CGA). It should be noted that no index child in the study weighed less than 2500 grams at birth, so that all children were within the "normal" range.

Part One of the study represents an attempt to compare growth patterns of the two groups, and to determine whether differences in body measurements of children in each group are related to within-group differential performance on psychological tests of mental development. The results indicate that current head circumference of the possibly malnourished index group of children is positively associated with performance on psychological tests of mental development. No such relationship was found for the control group, nor were statistically significant associations between any other

anthropometric measure and psychological test performance identified.

Part Two, which is complementary to Part One, involves looking at each child in the context of his home environment, and attempting to identify factors associated with children's assignment to the index or control group at birth, and with children's nutritional environment and growth since birth. The objectives of Part Two were modest; it was intended to be exploratory.

The results of Part Two show that, at the aggregate level for this sample, nutrition (in terms of protein and calorie intake) and growth are related. Children with birthweights on the low side of normalcy showed greater susceptibility to nutritional stress in early infancy, as far as it could be measured retrospectively, with some indications of sequelae in terms of head growth and intersensory function, although height by middle childhood was not affected.

Differences in child growth were found to be associated with such factors as: the extent to which the event, payday, changes food patterns in the household; the distance between home and the location of supermarkets patronized for the main food shopping (with a negative association between frequency of food shopping and growth, and with the availability of a private mode of transportation coming into play as a factor in both shopping distance and shopping frequency); sibship size, and especially ordinal position of propositus within the sibship; and residential stability, as well as reasons for residential moves.

Differences in the dietary intake data (protein and calorie intake) were found to be associated with: the frequency of pay periods; marital dissolution, either by death or divorce; and the use or non-use of speciality food shops, such as meat and fish markets and bakeries, for acquisition of at least part of the food supply.

Among the more interesting negative findings was the fact that, in this population, total household size, per se, was not related either to growth or dietary differences in children, and that factors intrinsic to the mother (such as her attitudes, training and knowledge) were not reflected in the diets or growth of children, except in extreme cases of a negative attitude toward food preparation and/or the lack of nutritional knowledge.

Efforts to evaluate the possible role of propositus, himself, in his diet and growth, were disappointingly inconclusive.

These findings are elaborated in greater detail in the main body of the report.

Back ound

Section A. Community Description

A cognitive definition of the boundaries of the total Northeast area of Kansas City, Kansas includes 16 census tracts (1970 classification): 401 through 412, 417, 418, 444 and 445 (see Figure 1). In 1970, this area included 88.1 per cent of the black population of the city.

However, the concentration of blacks within the Northeast area is not uniform. While four census tracts were more than 96 per cent black, the others ranged from 89.7 per cent to 0.8 per cent in 1970. Blacks are relative newcomers to some areas, and while moves are not always accompanied by an improvement in their standard of living, inclusion of these peripheral areas does increase the environmental variability which is a prerequisite for our research.

Within the total Northeast area, there is an "inner city" core, an older black residential area, bounded by 18th Street and I-635 on the west, by the city line on the north, by the Missouri Pacific railroad tracks and the Fairfax Industrial District on the east, and by Washington Boulevard (and Everett Avenue so-called on Figure 1 between 13th and 18th Streets) on the south. This core community, or Northeast Community (NEC) is comprised of census tracts 401, 402, and 407 through 412. A part of the core community is served by the Children and Youth Project, and this C and Y Project Area will sometimes be treated separately. The C and Y area includes census tracts 408 through 411.(1)

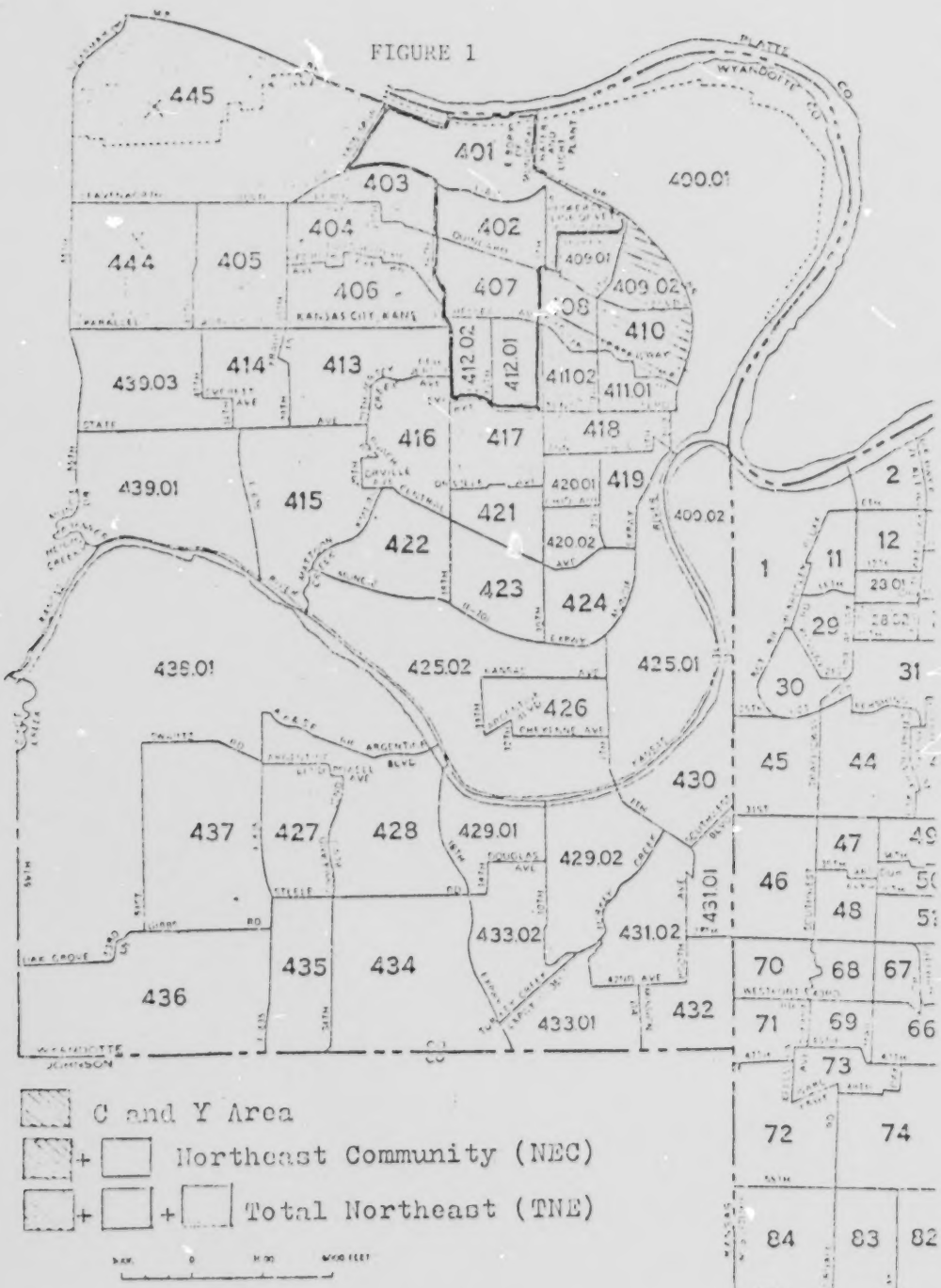
Table 1 shows that the cognitive definition of the Northeast Community fits quite well with the census tracts where black residents predominate. The one anomaly, tract 401, is due to the location of a largely white-occupied condominium development for war veterans, called "Quindaro Homes", in that area.

The three areas thus distinguished, C and Y area, rest of the core area and the peripheral area, differ not only in the concentration of black residents, but also in the characteristics of their black residents, including age distributions, educational attainment, family income, rates of unemployment, and their relative position on the poverty scale. These differences will be briefly outlined in turn.

1. Age Distribution

Population pyramids are shown in Figure 2 for, (1) the C and Y area, (2) the rest of the Northeast "core", (3) the area peripheral to the Northeast "core", which makes up the rest of the total

FIGURE 1



INSET B - KANSAS CITY, MO. - KANS. (PART)
AND VICINITY
1970

U. S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

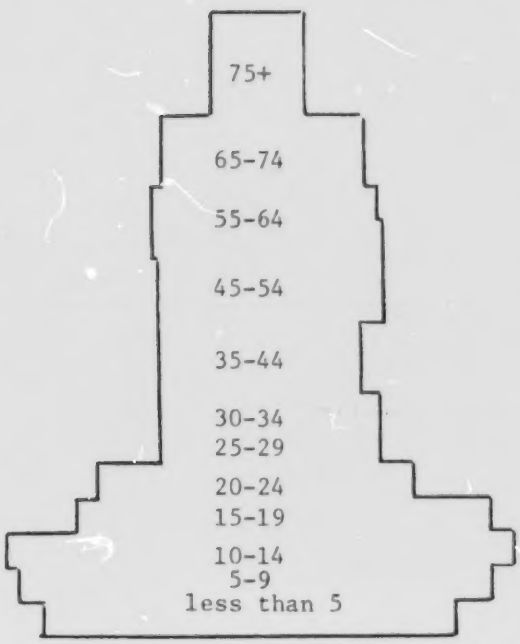
TABLE 1

Racial Distribution of Population of Kansas City, Kansas, for Selected Areas of the City, by Census Tract, 1970

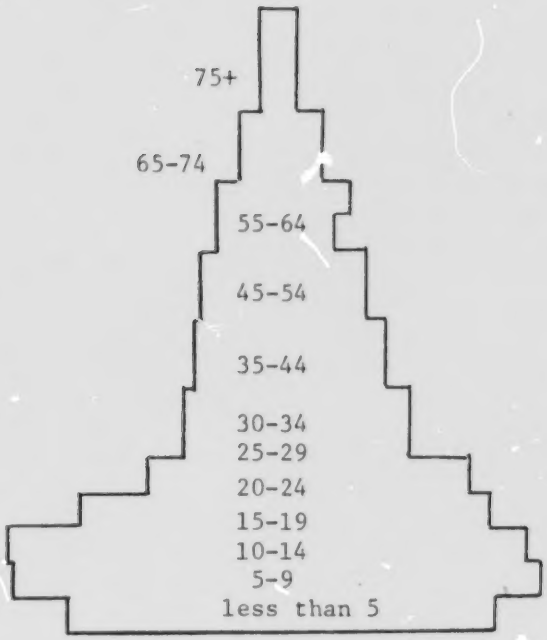
C & Y Areas:	Total C & Y	408	409	410	411
All races	13,367	2,126	3,187	4,668	3,386
Blacks	13,072	2,090	3,068	4,631	3,283
Per cent Black	97.8	98.3	96.3	99.2	97.0
"Northeast Community (NEC)"					
	Total NEC	401	402	407	412
All races	28,625	2,225	3,260	5,267	4,506
Blacks	24,169	1,000	2,144	4,724	3,229
Per cent Black	70.3	44.9	65.8	89.7	71.7
"Total Northeast (TNE)"					
	TNE	403	404	405	406
All races	51,845	1,955	3,608	3,091	3,852
Blacks	30,229	1,487	1,799	24	465
Per cent Black	58.3	76.1	49.9	0.8	12.1
		417	418	444	445
All races		3,524	979	3,486	2,725
Blacks		861	279	152	993
Per cent Black		24.4	28.5	4.4	36.4

Source: U.S. Department of Commerce, Bureau of the Census, Census Tract Reports, Series PHC (1), Kansas City, Kansas-Missouri SMSA Table, P-1.

FIGURE 2



(1)



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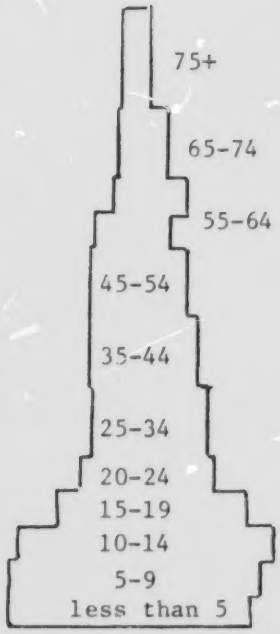

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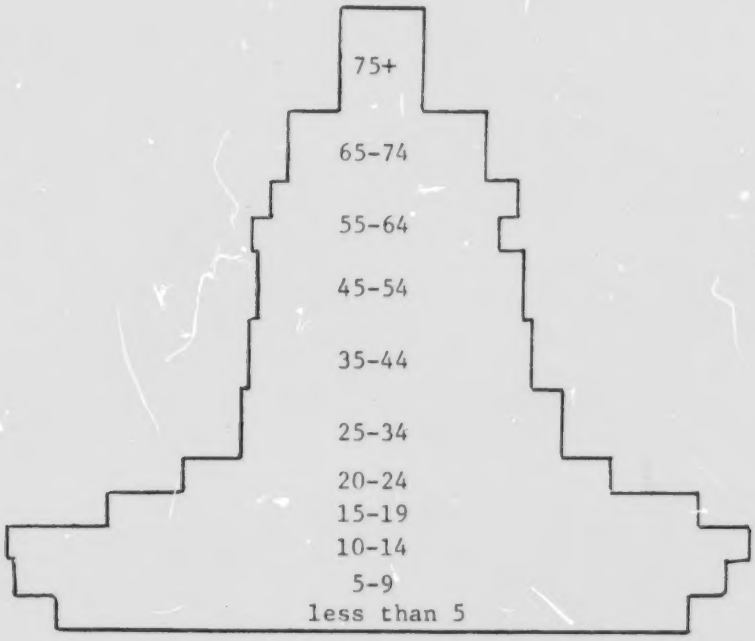

(4)

Northeast area, and (4) the total black population of Kansas City, Kansas, in 1970.

Proportionately, the C and Y area has many more older residents than the other areas. The C and Y area also has many children -- a feature it shares with the Northeast "core" in general -- while the peripheral area has fewer children.

2. Educational Attainment

There are also differences in educational attainment of residents from area to area (Table 2). The C and Y area has the lowest average (due in part to the larger proportion of old people there), while in the peripheral sections of the Northeast area, one finds a profile of educational attainment among blacks which is very close to and, at the higher level of the scale (high school graduates and above), exceeding the average for Kansas City, Kansas as a whole.

3. Income

Family incomes of blacks on the periphery of the Northeast area are higher than those of families in the "core", with the C and Y area the most depressed (Table 3). However, the educational superiority of blacks in the peripheral sections (reported above) is not reflected in their income profiles, as is shown in Figure 3. Blacks still lag far behind the average for Kansas City, Kansas in terms of income. This is, of course, a typical phenomenon inherited from regrettable past policies on the part of employers, and a not-so-exemplary present climate for economic equality in Kansas City, Kansas.

4. Unemployment

The 1969 data on unemployment in the Civilian Labor Force are grossly out-of-date, for 1969 was, relatively speaking, "good times", but the disparities, as shown in Table 4, are impressive. Unemployment among black males in the C and Y area was almost three times the average for all males in Kansas City, Kansas in 1969. The figure decreased in the more favored sections of the Northeast area, but remained above 6.5 per cent. Patterns for black females were not as variable, nor were they far above the average unemployment rate for females in Kansas City, Kansas as a whole.

5. Poverty Status

More than one-third of black households in the C and Y area would be classified as very poor in 1969 (i.e. with incomes less than 125% of the poverty level), compared with approximately one-fourth of those residing in the peripheral sections of the Northeast area (Table 5), a fact which also illustrates the economic mix one can find in a black ghetto. However, despite this limited relative improvement in some areas, blacks in Kansas City, Kansas are

TABLE 2

Educational Attainment of Black Residents of Northeast Kansas City, Kansas, 1970

	C & Y Area (1)	Rest of Northeast Core (2)	Peripheral Northeast (3)	Total Population K.C., Kans. (4)
Population, 25 years old and over	6,928	4,738	2,668	89,823
Per Cent of Population 25 years Old and Over With:				
No school years completed	2.1	1.5	1.8	1.0
Less than 5 years completed	11.4	7.9	4.9	4.4
5 or more years completed	88.6	92.1	95.2	95.6
8 or more years completed	68.7	76.6	84.1	84.4
High school or more completed	33.9	38.1	48.3	47.0
1-3 years of college or more completed	12.0	13.5	16.5	8.8
4 years of college or more	4.0	4.7	6.9	6.6

Source: Columns (1) - (3): U.S. Bureau of the Census, Census of Population and Housing: 1970, Census Tracts, Final Report PHC(1)-99, Kansas City, Mo.-Kans. SMSA, Table P-5.
Column (4): U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C18, Kansas, Table 83.

TABLE 3

Percent Distribution of Annual Incomes of Black Families in Northeast Kansas City, Kansas, 1969.

Income	C & Y Area (1)	Rest of Northeast Core (2)	Peripheral Northeast (3)
Less than $1,000	7.7%	5.4%	1.4%
1 - 1,999	7.0	4.9	7.4
2 - 2,999	9.1	7.2	3.4
3 - 3,999	10.0	6.7	6.8
4 - 4,999	9.4	9.5	7.6
5 - 5,999	11.2	7.7	10.2
6 - 6,999	7.2	6.9	6.8
7 - 7,999	6.8	10.0	7.7
8 - 8,999	5.1	9.0	8.0
9 - 9,999	4.5	7.7	6.3
10,000 +	22.0	24.9	34.4

Source: U.S. Bureau of the Census, Census of Population and Housing: 1970, Census Tracts, Final Report PHC(1)-99, Kansas City, Mo.-Kans. SMSA, Table P-6.

TABLE 4

Per Cent of the Civilian Labor Force Unemployed, Kansas City Kansas and Selected Areas, 1969

	Males	Females
1. Kansas City, Kansas		
a. Total	3.6%	4.0%
b. Black	7.9	5.6
2. Blacks, Selected Areas		
a. C & Y Area	10.2	5.4
b. Rest of Northeast "Core"	6.9	5.3
c. Peripheral Northeast	6.7	6.7
d. Total, Northeast Area	8.3	5.6

Sources: line 1a: U.S. Dept. of Commerce, Bureau of the Census, Census of Population: 1970, General Economic and Social Characteristics, Final Report PC(1)-C-18, Kansas, Table 85.
line 1b: Ibid., Table 92.
lines 2a-2d: U.S. Dept. of Commerce, Bureau of the Census, Census Tract Reports, Series PHC(1), Kansas City, Kansas-Missouri SMSA, Table P-6.

TABLE 5

Poverty Status of Families, Kansas City, Kansas and Selected Areas, 1969

	Percent of Families with Income:		
	< 75% of Poverty Level	< Poverty Level	< 125% of Poverty Level
1. Kansas City, Kansas			
a) Total	6.8%	10.0%	14.3%
b) Blacks	17.1	25.0	32.6
2. Blacks, Selected Areas			
a) C & Y Area	20.1	27.5	36.3
b) Rest of Northeast "Core"	15.2	25.2	30.6
c) Peripheral	11.6	18.8	26.2
d) Total, Northeast Area	16.7	24.5	32.3

Sources: Line 1a: U.S. Dept. of Commerce, Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C18, Kansas, Table 90.

Line 1b: Ibid., Table 95.

Lines 2a-2d: U.S. Bureau of the Census, Census of Population and Housing: 1970, Census Tracts, Final Report PHC(1)-99, Kansas City, Mo.-Kans. SNSA, Table P-6.

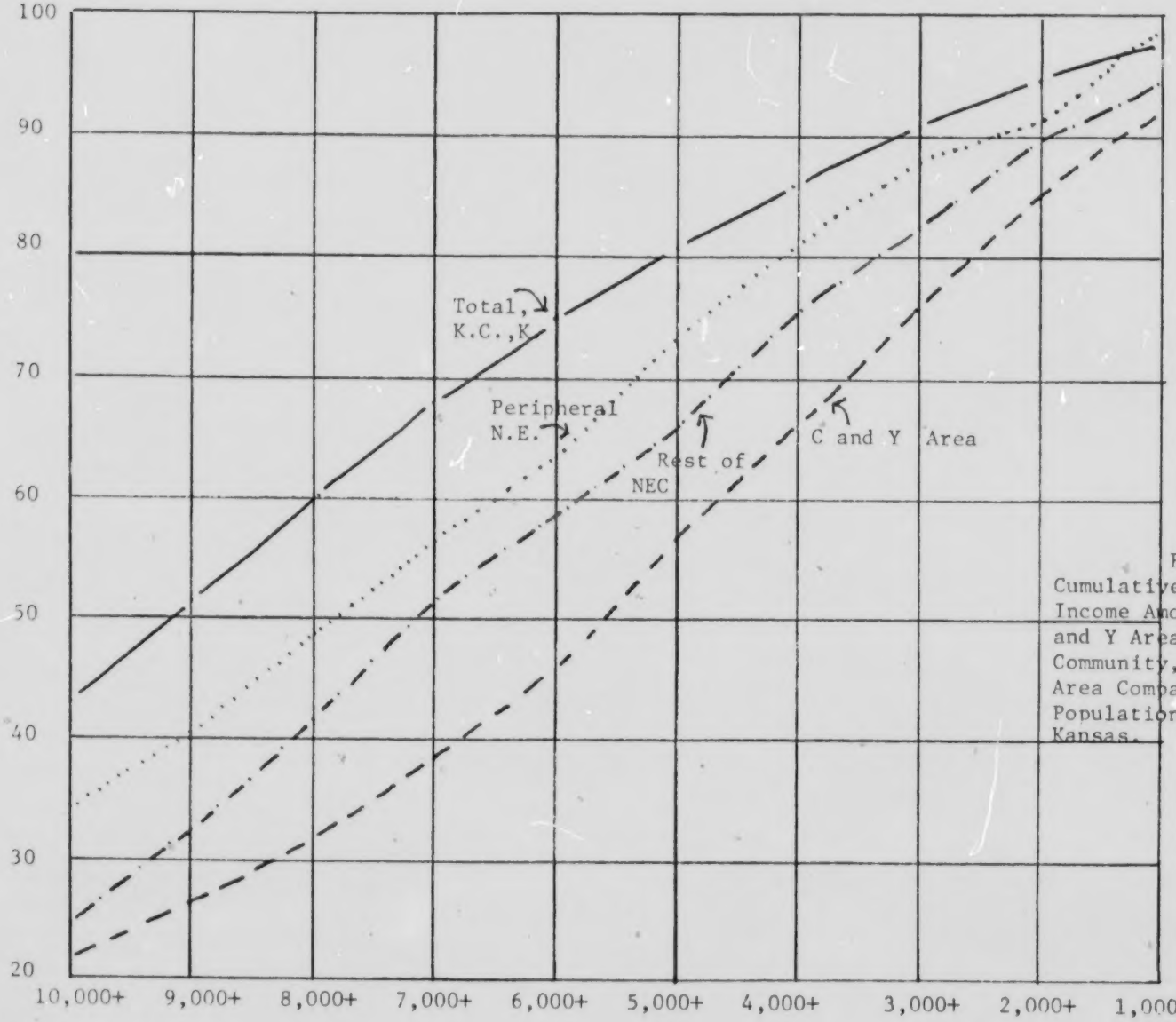

Figure 3
Cumulative Frequence of Family Income Among Blacks, 1969: C and Y Area, Rest of Northeast Community, Peripheral Northeast Area Compared with the Total Population of Kansas City, Kansas.

overrepresented among the poor by a factor of 2.5 times.

6. Physical Setting and Community Facilities

On the brighter side, the Northeast area of Kansas City, Kansas is a relatively pleasant ghetto, due mainly to its low population density, its impressive rate of home ownership (Table 6), and its attractive topography. It is located mainly along a broad ridge, with Quindaro Boulevard at its summit, and with small convolutions throughout the area providing a richly varied landscape and, in some parts of the core area, a dramatic view of the Kansas City, Missouri skyline.

There are only two public housing "projects" of any size (Juniper Gardens and Gateway Plaza), two condominium developments (Quindaro Homes and a smaller development spreading east from 27th St., several blocks north of Quindaro), and one large apartment complex, Fairfax Hills. The rest of the community is basically one of single-family dwellings, some of the larger of which have been converted for multi-family occupancy.

Often there is enough backyard space for a small garden, even in the "core" area, and good-sized garden plots are common on the northern and western edges.

The area is dotted with churches, schools, neighborhood grocery stores, restaurants, liquor stores, and all the other small establishments commonly associated with a ghetto economy, and most of them black-owned; but there are a number of black-owned businesses which do not fit that stereotype, such as the Walker Electric Co., D and H Tire Service, and the All-Science Exterminating Co., whose owner is an entomologist. The area also contains Douglass State Bank, Douglass Hospital, at least two medical buildings, a professional building, and the Hub Bookstore, the finest in Kansas City, Kansas.

Rapidly departing from the area are the supermarkets. In the past 2 ½ years alone, two large supermakrets and a medium-sized one have closed, leaving now only a relatively small A and P store at 13th and Quindaro, and a Milgram's (local white-owned chain) at 18th and Parallel. Except for families residing in the immediate neighborhood of these two supermarkets, transportation is necessary in order to purchase food at supermarket prices.

Section B. Sample Description

Although no attempt was made to select study families on the basis of the residential distribution of blacks within Kansas City, Kansas, Table 7 shows that the distribution of study families in 1974 does resemble that of the black population as a whole in 1970. Both index and control groups tend to be underrepresented in the C and Y

TABLE 6

Home Ownership in Selected Areas of Kansas City, Kansas, 1970

	Kansas City, Kansas		Northeast K.C. Kansas		C & Y Area	
	No.	Percent	No.	Percent	No.	Percent
Total Number of Units						
Owner occupied	36,600	100.0	10,861	29.7	2,218	6.1
By blacks	6,050	100.0	5,283	87.3	2,145	35.5
By whites	30,376	100.0	5,536	18.2	55	0.2
	Rest of Northeast Core		Peripheral Northeast			
	No.	Percent	No.	Percent		
Owner occupied	3,063	8.4	5,580	15.2		
By blacks	1,871	30.9	1,267	20.9		
By whites	1,182	3.9	4,299	14.2		

	Kansas City, Kansas		Northeast K.C. Kansas		C & Y Area	
	No.	Percent	No.	Percent	No.	Percent
Rencer occupied	18,296	100.0	6,229	34.0	2,395	13.1
By blacks	4,398	100.0	4,010	91.2	2,351	53.5
By whites	13,732	100.0	2,183	15.9	35	0.3
	Rest of Northeast Core		Peripheral Northeast			
	No.	Percent	No.	Percent		
Renter occupied	1,674	9.1	2,160	11.8		
By blacks	1,157	26.3	502	11.4		
By whites	505	3.7	1,643	12.0		

	KC,Ks.	Northeast KC,Ks.	C & Y Area	Rest of Northeast Core	Peripheral Northeast
Percent of black residents who own their homes	57.9	56.8	47.7	61.8	71.6
Percent of white residents who own their homes	68.9	71.7	61.1	70.1	72.3

Source: Bureau of the Census, Census of Population and Housing: 1970, Census Tracts, Final Report PHC(1)-99, Kansas City, Mo.-Ks SMSA, Table H-1.

TABLE 7

Distribution of the Black Population of Kansas City, Kansas, 1970, Compared with Distribution of Study Families, 1974

	Kansas City, Kansas		Northeast K.C. Kansas		C & Y Area	
	No.	Percent	No.	Percent	No.	Percent
1. Percent Black		20.4		58.3		97.8
2. Distribution of black population	34,345	100.0	30,229	88.0	13,072	38.1
Residential distribution of study families 1974 (percent)						
3. Index		89.3*		82.1		32.1
4. Control		96.4*		89.3		25.0
5. Total		92.9*		85.7		28.6

	Rest of Northeast Core		Peripheral Northeast	
	No.	Percent	No.	Percent
1. Percent Black		72.7		26.1
2. Distribution of black population	11,097	32.3	6,060	17.6
Residential distribution of study families 1974 (percent)				
3. Index		35.7		14.3
4. Control		39.3		25.0
5. Total		37.5		19.6

* The remaining families, although they still have strong ties in Kansas City, Kansas and were residents of Kansas City, Kansas at the time of the birth of the study child, were found to be living in Kansas City, Mo., 1973.

Sources: Lines 1 and 2: U.S. Bureau of the Census, Census of Population and Housing: 1970, Census Tracts, Final Report PHC (1)-99, Kansas City, Mo.-Ks. SMSA, Table P-1.

area, but it will be recalled that the C and Y area also contains a large concentration of older people. Control families are over-represented in the peripheral sections of the Northeast area, but it is probable that the population has also shifted that way since 1970.

It is interesting also that the C and Y area contains more index families than controls, while the more favored peripheral area contains more control families than index.

Footnotes to Background

1) In March of 1974, the C and Y service area was expanded to include census tract 412, but this change came too late to permit rearrangement of our data.

Methods

Section A. Sample Selection

The study population from which the sample was drawn consisted of three annual cohorts of black children born at the University of Kansas Medical Center in 1964, 1965, 1966, and whose mothers were last known to be residing in the Northeast area of Kansas City, Kansas. Their birth and medical records were perused, and the following items of data were posted: Child's hospital number, sex, name, date of birth, address at birth, latest address and date of latest address, parents' names, mother's previous deliveries, newborn's Apgar scores, calculated gestational age (CGA), birthweight, birth length, crown-rump length, head circumference, biparietal distance, chest circumference, a State code for complications of the pregnancy, a code for the newborn's condition at birth, a code summarizing the mother's diet during pregnancy, and whether the birth was single or multiple. Notes were also made on any other medical factors which might affect growth and/or development.[1]

Sample selection began by elimination of unwanted cases in the following order:

(1) Children for whom there was insufficient information on the criteria used for sample selection (birthweight, birth length, CGA, parity).
(2) Children whose gestation period was reported as less than 38 completed weeks, based on mothers' estimates.
(3) Children who weighed less than 2500 grams at birth.
(4) Children whose birth length was less than 47 centimeters.
(5) Cases where maternal diseases, complications of birth or fetal disorders which could have an adverse effect on the growth and/or development of the child, independent of nutritional factors, were known to be present.

All children who were not eliminated by this process made up the pool from which sample groups were selected, for each annual cohort. Those with the lowest birthweights were pulled as prospective index children[2], and then matched with two or three prospective controls (i.e. newborns of higher birthweight), on the basis of sex and, so far as possible, CGA and parity.

Section B. Fieldwork Procedures

Families of index children were contacted first. If the index child's family was located and agreed to participate, his control match was then recruited. Blind cards were made up so that most of the field research could be done without knowledge on the part of the interviewer as to the child's group assignment.

The fieldwork began with the questionnaire; then the developmental test was scheduled, with anthropometry on or near the test

day, and the dietary interview with the child as close to the test day as possible.

1. Questionnaire

Most of the interviewing was done at the child's home, although some took place at homes of friends or relatives, at laundromats, in doctors' waiting rooms, the emergency waiting room at KUMC and at the researchers' homes, depending on the informants' wishes. Four sessions were usually required, although the range was from two to eight. The food frequency interview with the mother was treated as the last part of the questionnaire.

2. Developmental Testing

We were fortunate in acquiring the services of Dr. Gail B. Butterfield, a psychologist who had had previous clinical experience with children in the Northeast area, and who undertook all the planning and execution of the psychological testing. During the summer of 1973, testing took place in our field office on 5th Street; after school resumed, some testing was done in the schools (with written parental consent, with the notification of and approval by a representative of the Kansas City, Kansas Board of Education, and with the permission and patient co-operation of school principals). Other rounds of testing were done on weekends and school holidays, in the home of our research assistant, who was by that time residing in the community.

Two tests were given: The Raven's Progressive Matrices Test and the Intersensory Integration Test (the latter was developed by Herbert G. Birch and Arthur Lefford, and described in a monograph, see Birch and Lefford, 1963).

The Raven's was administered first, followed by an abbreviated form of the Intersensory Integration Test, which basically amounted to eliminating the redundancy.[3] Both tests could be given in the same session, usually within an hour, although no time limitations were set.

The tester, test schedule and the apparatus were always the same. The test setting varied (office or school or house), although Dr. Butterfield and her subject were always alone. Lighting and temperature also varied (it was usually either too cold or too hot). However, the total atmosphere was very uniform, due to the great success of Dr. Butterfield in making each child feel comfortable.[4] Dr. Butterfield never knew beforehand whether she was testing an index or a control child.

3. Anthropometry

Anthropometric measurements were made either on the same day as the developmental testing or within a few days before or after. All measurements were performed by one individual, the research assistant, using the same instruments. Children wore light clothing and no shoes.

A bathroom-type scale, with readings in kilograms, was used for weight. The scale had been selected and specially tested by a very helpful employee of the Acme Scale and Service Company of Kansas City, Missouri, who simply became interested in our problem. Lange calipers were used for the skinfold measurements.

4. Dietary Interview

A 24-hour recall dietary interview was done with each child. The reference day was always a school day. Children had all been told that one day we would come and ask them what they "ate yesterday."

Children were interviewed wherever we found them. Other children, relatives and friends, usually gathered during the interview and were often helpful in prodding propositus' memory, but wherever there was disagreement as to exactly what propositus had eaten, we took propositus' word as final.

The food frequency interview, which was attached to the questionnaire, was usually inflated, as compared to propositus' report. Often mothers realized this, and they would say "That's too many meats, isn't it?" Therefore, the food frequency table was used only as a background to the 24-hour recall survey.

Section C. Ordering the Data

Methods used to adjust anthropometry and developmental test results for age differences of children are described in Part One of the main body of this report.

In order to minimize the effects of observer bias on the questionnaire material, categories for coding the questionnaire were not defined until the interviewing was virtually complete. At that time, responses on the questionnaire were reviewed for implicit patterns, item-by-item.

Children's dietary intakes during a weekday, collected by the 24-hour recall method and based on recommendations contained in a U.S. Department of Health, Education and Welfare document (1971: 12-13), were converted to grams protein and total calories by values published in a U.S. Department of Agriculture Handbook (1963). Conversion factors used are given in Appendix IV.

Section D. Difficulties Encountered

By the very nature of this research, there had to be difficulties, but there were two events, external to the research design and to the community, which posed a crisis of confidence in the ethics of the researchers and their research. Questions were also raised as to the efficacy of the research. Finally, there were the more conventional difficulties of implementation of the fieldwork.

Two months after the study formally began, in July, 1972, the Tuskegee syphilis scandal broke, bringing to the foreground the issue of ethics in human experimentation. We, of course, were not "experimenting", but we were nevertheless confronted with questions, from community residents, as to whether ours was a "guinea pig" study. We took the challenge of the questions seriously. The gist of our reply was that it depended upon how one defined a "guinea pig" study, and that those studies and ours were similar in that there were no guaranteed benefits for participants, although we were quick to point out that our research also was not potentially harmful. Those who listened were usually satisfied, but some, in the heat of their resentment, refused to participate.

Added to the Tuskegee scandal was the Watergate scandal, which began to unfold just at the peak of our field research, and in some cases hampered our credibility. The low point here was the refusal of one person even to believe that our white female researcher was who she said she was, identification cards notwithstanding. There were rumors adrift that she was an undercover agent of various sorts.

Even when the stated nature of our research was accepted as fact, the question of its utility was often raised, and it was difficult to respond to those who said "we have been researched and researched, and what good does it do us?"

One mother called us half-way through the interviewing sequence to say that when she told her child that he was scheduled to take our developmental test at school, the child had asked her wearily, "Why do I have to do that?" She told us his question had impressed her and, after thinking about it, she concluded "Yes, indeed, why?" This particular case was salvaged by going to the home and discussing the problem, but the mother's final consent to continue was based on her compassion for the position of the field researchers who, of course, had to collect data. She made clear, as did many others, her opinion that it was useless to collect more data on blacks which would be twisted into the familiar stereotypic interpretations.

In addition to ambience, there were two more mechanical difficulties: location of families and the keeping of appointments. Younger parents were especially difficult to find. Neighbors at the

last known address of a family were often helpful, but where several houses or a whole block had been demolished, tracing was difficult. Parents of parents could sometimes be found. Personal networks became increasingly valuable, obituaries and other local newspaper materials were scanned.

Sample size was seriously affected by this problem, because index families were especially hard to locate, but once contacted, they were usually more receptive to the idea of participation than control families. Control families were in general easier to find but not as easily recruited.

Many of the scheduled interviews aborted because the informant was not at home at the appointed time, but in only four cases did this represent a non-verbal expression of unwillingness to participate. The first interview had the highest failure rate; subsequent interviews were usually scheduled a week hence at the same hour, which created a routine.

Sometimes interviews were terminated by the researchers, when they became aware, on arriving at a home, that a family matter existed, which would have made the interview difficult for the informant at that time. Interviewers always offered assistance in emergencies and rescheduled the interview.

All these changes in interviewing arrangements were costly in terms of research time, but they added greatly to the rapport between interviewers and participating families, and patience was rewarded when an informant would finally sit down with a smile and say "Now we can talk."

Footnotes to Methods

1) We have limited information on health problems which may have been attended by a private physician or at another hospital or clinic. This information was gathered by means of brief medical histories for each child, during the field interviewing with the child's mother.

2) Our original research proposal listed birthweight as the criterion of nutritional status which would be used. By the time of the first interim report, we had changed our criterion to Rohrer's ponderal index (PI), which is the ratio of birthweight (in grams) to the cube of birth length (in centimeters). However, we soon began to distrust the data on birth length, because wherever the PI was low, the ratio, birth length/head circumference was always high, and vice versa. The birth length-to-head circumference ratio has been described as very stable among newborns and independent of gestational age, parity, race and sex (Miller and Hassanein, 1971: 514). Errors in birth length alone could have explained the pattern, for birth length was in the denominator of one ratio and the numerator of the other. Advice from several individuals with experience in newborn anthropometry further contributed to our wariness of the birth length data, to the point where we finally reverted to birthweight, as the empirically more reliable criterion. Because of this change, we were forced to discard some of the families we had already begun interviewing, with some time lost but, we feel, with the result that the two groups are better defined.

3) The Intersensory Integration Test was cut by limiting items to preferred hand only (which decreased the number of items by one-half), and by elimination of the circle as a stimulus form. According to tables shown in the monograph by Birch and Lefford, the circle was the easiest form for all ages to recognize, and was therefore a poor discriminator of intersensory function.

4) One child, an index child, had to be removed from the sample, because he "locked in" on a systematic response to test items. All other tests were judged satisfactory, and children emerged triumphant, with the impression that they had "got all the answers right." Some complained that their arm had tired during the Intersensory Integration Test, and these were given a rest period for their muscles to recuperate. A number of children asked when they could come back and play "the games" some more.

PART ONE

Introduction

Part One is the core of the study as it relates to questions of physical growth and mental development in children.

The data on which the results are based have been treated in the simplest manner possible. Section A describes the methods used to convert raw data to a form amenable to analysis. Basically, this involved adjusting for age differences of the children. Sections B and C present salient findings on the anthropometry and developmental test scores, respectively, which, in turn, are analysed for patterns in section D.

Section A. Adjustments for Age

Since chronological ages of children varied at the time they were measured and tested, adjustments have been made to the age-dependent variables, current height, current head circumference, and performance on the Intersensory Integration Test and on the Raven's Progressive Matrices.

1. Current Height

"Height quotients" were calculated as described in Cheek (1968:609). The height quotient:

$$HQ = \frac{\text{Height age}}{\text{Chronological age}} \times 100$$

Height age was derived from tables of mean height for U.S. black children provided by the National Center for Health Statistics as Part of the National Health Survey (U.S. Department of Health, Education and Welfare, 1970). Monthly data were estimated by linear interpolation of mean height at yearly age intervals, with males and females treated separately.

2. Head Circumference

In order to adjust current head circumference for age, a "head circumference quotient" was calculated in the manner described above for height. "Head circumference quotient":

$$HCQ = \frac{\text{Head circumference age}}{\text{Chronological age}} \times 100,$$

where head circumference age was read from mean head circumference on the Practical Composite International and Interracial Graphs

(P.C.I.I.G.), prepared by Nellhaus (1968: 107-8).

3. Intersensory Integration Test

The Intersensory Integration Test scores of children in the study were standardized for age on the scores of a group of "bright normal" school children in a predominantly middle class suburb of New York, data for which are published in the original paper describing the test (Birch and Lefford, 1963). The sole purpose in standardizing the scores was to adjust for within-group age differences.

The standardization was done by the following steps: 1) Mean errors (preferred hand only, from tables 4 and 5 of Birch and Lefford, 1963) were converted to per cent correct responses for 7, 8 and 9-year olds in the New York sample.[1] 2) The same calculation was made using the scores of individual children in our sample. 3) An index (New York scores for each age interval = 100) was calculated for each sample child.[2]

These steps were repeated for three configurations of the Intersensory Integration Test scores: Performance on the total test, performance in visual-kinesthetic plus haptic-kinesthetic integration, and performance in judgment of identical stimulus forms.[3]

4. Raven's Progressive Matrices

Raw scores on the Raven's Progressive Matrices test were adjusted for age differences, using the table provided in the test manual. The table was derived from scores of a group of children in the United Kingdom, but again, as with the Intersensory Integration Test, the appropriateness of the "standard" population to the population being standardized is of lesser interest, because the purpose of the calculation was to adjust raw scores for within-group age differences, not to compare our children with any other population.

The U.K. score at the 50th percentile, for each age category (at 6-month intervals) was used as the base of an index:

$$\frac{\text{Each child's score}}{\text{Published standard score-for-age}} \times 100.$$

Adjustments of raw scores on the Raven's Progressive Matrices were done in this manner, in order to make them roughly comparable to the age-adjusted Intersensory Integration Test scores described above, with the difference that the former are based on median values, while the latter are based on mean values.

It should be noted that the resultant scores are not

comparable to an IQ.

Section B. Anthropometry

Summary data comparing the anthropometry of the two sample groups are shown in Table 1.1. (The basic data are provided in Appendix I). By definition, the two groups do not overlap with respect to birthweight, but also, mean head circumference at birth is significantly different for the two groups ($t = 5.810$, $p < .01$), and the difference in means for current head circumference is statistically significant ($t = 3.011$, $p < .01$). While it is not possible to assert that there is biological significance in these differences, statistically the groups are distinguishable on the basis of these anthropometric criteria. Head circumference at birth correlates significantly with current head circumference in the index group ($r = .512$, $p < .01$), but not in the control group ($r = .348$, $p < .05$).

However, although children in the index group are, on the average, somewhat smaller in stature, have lower weight-height ratios and a smaller mean arm circumference, none of these differences are statistically significant.

Section C. Developmental Testing

Mean performance on the Raven's Progressive Matrices test (adjusted for age) was better for the index group than for the controls (a finding which could only be explained by conjecture), but mean performance on the Intersensory Integration Test (adjusted for age) was the same for both groups and identical to the mean for the "standard" population, i.e. the mean value was 100 except for the total score for controls, which was still a close 99 (Basic data on developmental test scores are provided in Appendix II).

Although between-group differences in level of performance on developmental tests were not observed (and there was no reason to expect that they should be), patterns of within-group variation on the developmental tests, as they correlated with anthropometric measurements, were different for the two groups.

Section D. Correlations Between Anthropometric Measurements and Performance on Developmental Tests

Birthweight, head circumference at birth, current head circumference, "head circumference quotient" (described in section A), and height quotient (described in section A) were compared with performance on the developmental tests, using Pearson's "r". The results are shown in Table 1.2.

TABLE 1.1

Anthropometric Measurements: Index and Control Groups Compared

	Index (a)		Control (a)	
	Mean	S.D.	Mean	S.D.
Birthweight (gm.)	2670	±106	3461	±237
Birth length (cm.)	49.1	±1.3	50.1	±1.8
Head circumference at birth (cm.)	32.9(b)	±1.1	34.8	±1.3
Age at current measurements (yrs.)	8.7		8.7	
Stature (cm.)	130.7	±6.9	132.5	±5.8
Height quotient	98.4	±11.0	103.7	±13.4
Weight-height ratio	20.9	±3.0	21.6	±2.6
Current head circumference (cm.)	51.4	±1.3	52.6	±1.7
Head circumference quotient	78.2	±32.7	116.1	±52.8
Arm circumference	19.5	±2.2	19.8	±2.0

(a) N = 28
(b) N = 27

TABLE 1.2

Coefficients of Correlation Between Anthropometric Measurements and Developmental Test Performance: Index and Control Groups Compared

			Index N=28		Control N=28	
			r_{xy}	P	r_{xy}	P
Birthweight	X	RQ[a]	+.129	NS	+.034	NS
		ITT_{TOT}	+.191	NS	+.151	NS
		VK + HK	+.130	NS	+.140	NS
		ID	-.038	NS	+.114	NS
Head Circumference at Birth	X	RQ	+.125[b]	NS	-.091	NS
		ITT_{TOT}	+.227[b]	NS	+.193	NS
		VK + HK	+.224[b]	NS	+.176	NS
		ID	+.376[b]	<.05	+.068	NS
Current Head Circumference	X	RQ	+.371	<.05	+.096	NS
		ITT_{TOT}	+.395	<.05	+.233	NS
		VK + HK	+.406	<.05	+.303	NS
		ID	+.418	<.05	+.272	NS
Head Circumference Quotient	X	RQ	+.388	<.05	+.103	NS
		ITT_{TOT}	+.452	<.02	+.109	NS
		VK + HK	+.464	<.02	+.190	NS
		ID	+.388	<.05	+.155	NS
Height Quotient	X	RQ	-.082	NS	+.094	NS
		ITT_{TOT}	+.070	NS	-.020	NS
		VK + HK	+.055	NS	+.094	NS
		ID	+.070	NS	+.067	NS

(a) RQ = Raven's scores, adjusted for age; ITT_{TOT} = Total score, Intersensory Integration Test, adjusted for age; VK + HK = Performance in visual-kinesthetic plus haptic-kinesthetic integration, adjusted for age; ID = Performance in judgment of identical forms, adjusted for age.

(b) N = 27

For the control group, no correlation between the two sets of parameters was significant at the 5 per cent level, while for the index group, statistically significant correlations were found between performance on the developmental tests and both current head circumference and head circumference quotient (p ranging from $< .05$ to $< .02$), although differences between correlation coefficients for the two groups were not significant at the 5 per cent level. None of the other anthropometric measurements for the index group correlated significantly with test performance.

These data are suggestive of the possibility that even moderately low birthweight (i.e. $>$ 2500 grams, but in the low range of normalcy), when accompanied by slow head growth in infancy and early childhood, may be associated with an inhibition of mental development, whereas the same birthweight deficit, when followed by normal head growth after birth, is not associated with inhibition of mental development.

Conclusions based on these data must be highly tentative, due to the small size (56 children) of the study population. However, the findings do suggest that, in the absence of evidence to the contrary, it would be prudent to give special attention to the postnatal head growth of relatively small but clinically normal full-term infants.

Footnotes to Part One

1) The New York data included the circle as a stimulus-form, which (for brevity) was eliminated from our test, and has the effect of depressing all the scores in our sample. However, it was assumed that the amount of distortion was constant within the two study groups and across age categories, because the circle was described by Birch and Lefford to be a very easy stimulus-form to identify, at all age levels, and was therefore a poor discriminator of age differences in intersensory function.

2) No adjustment was made for sex differences, because cells were too small.

3) The two other possible part-configurations, visual-haptic integration and judgment of dissimilar forms, were relatively less challenging for all ages, and are, therefore, ignored (except as components of the total score) as poor discriminators of intersensory function.

PART TWO

Introduction

Part Two represents an attempt to relate what is known about each child's physical growth and mental development to what is known about his diet and other facets of his environment, since conception.

The primary focus has been on parameters which could provide more detail on the environment than those commonly used (e.g. family income or a measure of socio-economic status). Some of the questions asked during the course of the interviewing, such as whether or not a family has a private source of transportation, or where and when the major food shopping is done, permitted fairly objective responses; others, such as those relating to changes in diet over time, or the food habits of children, involved subjective appraisals on the part of parents; still others, such as what foods might harm healthy children, involved opinion based on some form of knowledge, "scientific" or otherwise. All of the questions were chosen for their possible relevance to the well-being of sample children, and it is the purpose of Part Two to test this possibility, on the basis of the degree of association between responses to the questions, and dietary and/or growth parameters.

Since the results from Part One serve as a framework for Part Two, the findings in Part 1 will be briefly recapitulated. Children were originally selected on the basis of differences in birthweight. Some overall suppression of current anthropometric measurements for the index group has persisted over time (see Table 2.1), although differences between the index and control group means are statistically significant only for head circumferences.

The correlation between head circumference at birth and current head circumference-for-age (head circumference quotient) is positive and statistically significant for the index group ($r = +.636$, $p < .01$), and not significant for the control group ($r = +.251$, $p > .10$).[1] However, there is no significant correlation between head circumference at birth and performance on the developmental tests in childhood, for either group.

In view of the significant within-group correlation between current head circumference quotient and performance on tests for mental development among index children, and the absence of such a correlation among the controls, it seems imperative to know to what extent environmental factors play a role. In Sections A, B and C of Part Two, environmental factors have been examined for possible associations with birthweight and head circumference.

TABLE 2.1

Mean Values for Selected Anthropometric Measurements:
Index and Control Groups Compared
(N = 28 in each group)

Measurement	Mean		Difference between means	
	Index	Control	t	p
Birthweight (gms.)	2670 ±106	3461 ±237	*	*
Head circumference at birth (HC_o) (cm)	32.9[a] ±1.1	34.8 ±1.3	5.81	<.01
Current head circumference (HC_1) (cm)	51.4 ±1.3	52.6 ±1.7	3.01	<.01
Current head circumference quotient (HC_1Q)	78.2	116.1	3.81	<.01
Current height quotient (HQ)	98.4 ±11.0	103.7 ±13.4	1.58	NS
Weight ÷ Height X100	20.9	21.6	0.90	NS

* Not applicable. The two groups were defined as different groups on the basis of birthweight.

a) N = 27

One would look for related environmental factors during the gestational period and early infancy, when brain and head growth are most rapid and therefore most susceptible to environmental stress. Retrospective data for this period, based on interviews with mothers, are tabulated, with emphasis on maternal and infant diet.

Many of the index children have experienced satisfactory linear growth since birth, while some control children have lagged behind; within-group variations in birthweight are not predictive of subsequent growth for either group, and the difference between mean height quotients of the two groups is not statistically significant, suggesting, not surprisingly, that other factors have been operating in the seven, eight or nine years since birth. Section D of Part Two will focus on the childrens' current growth, nutritional environment and other related factors, based on dietary and other data collected during the field interviewing. Because the data on current stature indicate that differences between the two groups have largely disappeared by middle childhood, the groups will be combined in Section D.

To search for the environmental differences associated with observed patterns of growth and development of these children is not to deny the importance of genetic factors as they affect growth and development directly, and indirectly through their effect on maturation, utilization of nutrients, etc. Nor is it possible to infer causation even when environmental differences are observed; we are faced with the usual discontinuity between association and causation. This is a relatively young area of inquiry, and the mechanisms by which various factors interact are largely unknown. The main purpose here has been to ask a battery of questions related to familial behavior and the child's home environment, and which might provide additional dimensions to the dynamics of the total picture.

Early in the period of field observation, it became clear that no two families have the same configuration of attitudes, desires, resources, habits and constraints. Although we have interviewed and studied "families", in the analysis to follow it is "traits" (or isolated responses to individual questions), not "families", which are the unit of analysis. Members of each family interviewed (usually the child's mother) have answered questions, and the responses of groups of families have been compared for each individual question. This approach is equivalent to treating families as if they were bundles of "traits", which they are not.

While the "trait" level is the only one practical for this type of exploratory analysis, the two levels are not interchangeable. It is a common dilemma that, in order to organize data and make generalizations, it is sometimes necessary to fragment information on a complex unit, such as the family, into

smaller parts amenable to analysis, but with the result that what is learned about a group of families may not be true for any individual family.[2]

The data presented here are based on 56 children (28 index children and 28 matched controls). Percentages have been used in many of the tables for simplicity of comparison, so that each child usually equals 3.7 per cent. The use of percentages also provided a convenient means of adjustment for a small amount of spotty non-reporting.[3]

The data are ordered according to the time sequence in which events occurred: first is an inter-generational question for the mother, with index and control mothers compared; next, questions relating to the maternal environment during pregnancy, again with index and control mothers compared; then, questions on the child's infancy, which are analyzed in terms of subsequent head growth in the children, as well as their performance on tests of mental development; and finally, questions relating to the childhood environment, which involve the search for environmental parameters which may be associated with a child's nutrition and/or growth.

Section A. Changes Over a Generation

Mothers were asked to evaluate and compare the present diets of their families with what they could remember of their own diets as children (Table 2.2). Eighty-five per cent of mothers of control children said their family is presently eating as well as, or better than they had in their own girlhoods, compared with 57 per cent of mothers of index children.

The question was unstructured in terms of reasons for the changes. The responses suggest that, while poorer food habits (mostly a preference for "junk") accounted for a large part of the reported deterioration in quality of the diet, improvement of diet, where it has occurred, has been associated with improvement in financial condition of the family over time.[4]

Section B. Prenatal environment

Events surrounding pregnancies have been categorized as "non-food" (Table 2.3) or "food" (Tables 2.4 and 2.5), and responses by mothers of the two groups of children compared. Table 2.3 shows that control mothers were aware of their pregnancies earlier than index mothers, they availed themselves of medical supervision earlier and reported to the University of Kansas Medical Center's obstetrical clinic at an earlier stage in their pregnancies. While 14 per cent of index mothers had made no prenatal visits to the Medical Center[5], there were no such cases among mothers of control

TABLE 2.2

Mothers of Index and Control Children Compared in their Responses to the Question: "Do you think the people in this house eat better than you did when you were a girl? Why?"

Response	Index	Control
Same or better now	57%	85%
Same	21	37
Better now	36	48
Due to:		
Change in economics	18	37
Change in food patterns	14	11
Change in residence patterns	4	0
Worse now		
Due to:		
Change in economics	7	4
Change in food patterns	29	7
Change in residence patterns	7	4

TABLE 2.3

Non-Food Events Surrounding Pregnancies: Index and Control Mothers Compared

	Index (percent)	Control (percent)
Month pregnancy was known:		
First	44%	68%
Second	26	16
Third	11	12
Later than third	7	4
Don't remember	11	0
Month of first medical attention		
First	15	38
Second	30	15
Third	15	15
Later than third	41	31
Trimester in which supervision of pregnancy began at KU		
First	14	25
Second	50	54
Third	21	21
At birth	14	0
Activity outside the home during pregnancy		
Work	26	28
School	7	12
None	67	60
Means of transportation to KU for childbirth		
Driven by baby's father	59	64
Driven by relative	26	28
Driven by friend	7	4
Public transportation, alone	7	4

TABLE 2.4

Tabulation of Responses to Questions on Mothers' Foods During their Pregnancies

		Index	Control
Question: Did you have any trouble with food during your pregnancy with ____?			
	No	74%	77%
	Yes	26	23
Question: Did your appetite increase during that pregnancy?	No	56	40
	Yes	44	60
Question: Do you think you eat better now than you did when you were pregnant with ____? Explain			
Same		26	50
Worse now ("No")		26	19
Due to:			
Different food pattern		22	19
Economic changes		4	-
Better now ("Yes")			
Due to:			
Different food pattern including diet		11	12
Economic changes		11	12
Small appetite or digestive problem		19	8
Idiosyncratic*		7	-

* "I always eat in spurts."

children. Altogether, control mothers were the more conventional in their use of medical supervision during their pregnancies.

However, the proportion of mothers engaging in outside activities, either at jobs or school, during some part of their pregnancies, was about the same for both groups. Among both groups, childrens' fathers seem to have been equally attentive in providing transportation to the hospital at delivery time.

Eight to ten years have elapsed since the time of these pregnancies, so it was possible to ask only general questions regarding food during that period. Therefore, the subject was approached by several avenues. Women were asked whether they have had any "trouble with food" during their pregnancies. This elicited almost identical responses in both groups (Table 2.4), with approximately three-fourths of mothers in each group reporting no trouble (short bouts with "morning" or "night-sickness" were categorized as "no trouble"). Fifty-eight per cent of control mothers reported an increase in appetite during their pregnancy with propositus, compared with 41 per cent of index mothers.[6]

When asked to evaluate and compare their diets now with how they were eating when pregnant, almost twice as many control mothers as index mothers said there has been no change ("Same" implied adequacy of food supply: "I got everything I wanted."). Forty-one per cent of index mothers said they eat better now than then, compared with 31 per cent of controls, but this difference was due mainly to general loss of appetite or digestive problems, which were more often sufficiently severe in the index group to override other factors.

Women in both groups who had been put on a calorie and/or sodium-restricted diet by doctors reported that they eat better now than they did when they were pregnant.[7] Two index mothers, with idiosyncratic lifetime eating habits, could not be classified.

Finally, mothers were asked whether there were any foods a pregnant woman should not eat, and whether there were any which were especially good for a pregnant woman (Table 2.5). Although foods declared harmful might not have been rigorously avoided, the assumption was that those foods recalled as "especially good" for a pregnant woman are likely to have been consumed in proportion to the number of times they were remembered and mentioned.[8]

In general, control mothers offered more information on foods beneficial to a pregnant woman. Some form of animal protein was mentioned by 72 per cent of control mothers, compared to 54 per cent of index mothers. Milk and/or milk products were mentioned by 68 per cent of control mothers, compared with only 37 per cent of index mothers, while vegetables were given the highest priority

TABLE 2.5

Tabulation (percent) of Mothers' Responses, by Food Category

	Index (percent)	Control (percent)
Question: "Are there any foods which a pregnant woman should not eat?"		
Salt	19%	36%
Starches and sweets	15	20
Spicy foods	19	4
Fatty foods	11	0
"Don't know"	11	12
"No"	44	40
Question: "Are there any foods which are especially good for a pregnant woman?"		
Vegetables	56	60
Some form of animal protein	54	72
Milk and/or milk products	37	68
Meat, fish, poultry, eggs	41	36
Fruit	22	24
Juices	4	12
Other fluids	11	16
Bread or cereal products	-	8
"Don't know"	11	8
"No"	11	4

by index mothers (56 per cent) and second-highest priority by control mothers (60 per cent). Meat, fish, poultry or eggs were mentioned by only 41 per cent of index mothers and 36 per cent of control mothers. Fruit was the last food item which made any kind of showing at all, mentioned by 22 per cent of index mothers and 24 per cent of control mothers. Bread or cereal products were not even mentioned by the index group, and practically forgotten (8 per cent) by control mothers, possibly because they are staple items.

Twenty-two per cent of index mothers either did not know what foods were especially good for a pregnant woman, or felt that no particular foods were universally beneficial, compared with 12 per cent of control mothers. Only one mother (of an index child) took the extreme view: "Foods don't keep you healthy, really. I'm healthy and I don't eat." Her newborn weight 5 3/4 pounds.

In summary, control mothers more often reported increases in their appetites and better diets during their pregnancies. There is indirect evidence to suggest that animal protein was more prevalent in their diets.

Section C. Diet in Early Infancy and Current Head Circumference

If, as has been suggested earlier, postnatal head growth is associated with differential rates of mental development among those children with birthweights on the low side of normalcy, it would be desirable to know to what extent head growth is related to differences in the nutritional experience of these children during their infancy, when the rate of brain growth is still high.

Since the collection of data on this phase of the child's life required a mother to go back some six to nine years in her memory, it was decided to ask her very general questions, to structure only a temporal sequence in order to help her remember, and to leave the details up to her. Six questions were asked: 1) "Did you breastfeed any of your children?" 2) (If propositus was not breastfed) "What did you feed _____ after you brought him home?" 3) "Can you tell me how you changed ____'s foods as he grew?" 4) "Was ____ a fussy or greedy eater when he was smaller?" 5) "How old was ____ when he learned to feed himself so you didn't have to bother with him anymore?"

Data are tabulated in terms of categories implicit in mothers' responses. In addition to between-group comparisons, children in each of the two groups are ranked according to current head circumference quotient and their total score on the intersensory integration test, and within-group comparisons are made between those children above and below the medians for their group.

1. Breastfeeding

The incidence of breastfeeding was higher for the controls (Table 2.6). Three mothers in the index group who did not breastfeed, said they had tried to, compared with only one mother in the control group.[9] Breastfeeding was more prevalent among mothers of index children above the median for head circumference quotient than for those below.

2. Prolonged Milk Regimen

Among such a small number of newborns, one can expect but few extreme cases on the dietary continuum. However, there were four instances of a prolonged milk regimen (i.e., exclusive consumption of milk for more than six months), three in the index group and one control child. The three index children all rank below the median in both head circumference quotient and intersensory integration test performance. The control child is just above the median in terms of head circumference for age, but below the median in intersensory integration test performance.

3. Introduction of Other Foods

The tabulations show great variability in the use of and ages at which foods other than milk are introduced, with a wide range among both groups, as well as for the half-groups defined on the basis of current head circumference quotient[10] (Table 2.7).

In general it appears that the nutritional experience of index children above the median for current head circumference quotient is more similar to the experience of the control children than to the experience of index children below the median.

Field interviewers noted that parents exercised considerable individuality and pragmatism in the feeding of their infants, and the factors influencing their decisions were as myriad as the practices themselves. Often mothers reported they had read their infants for cues: "It just seemed like the bottle wasn't enough for him -- he was always hungry." Economics also played a role: "We gave him the Similac samples, but (father) was only making $36 a week, so we had to use condensed milk ... couldn't afford baby food." An older female relative, whose advice and success with other children were respected, might be at least influential, and sometimes directly in charge of the food supply for the infant. This was associated with the earlier introduction of solid foods in the form of cornbread soaked in meat gravies or juice from greens ("Once he got the 'fat taste' he wouldn't go back to baby foods."), or mashed potatoes, as well as pre-mastication of other table foods (mostly meats) by, usually, the infant's grandmother, beginning at around the fourth month.[11]

TABLE 2.6

Incidence of Breastfeeding: Index and Control Groups Compared

	Index	Control
Percent infants breastfed	22%	44%
Of which:		
Above median for HC_1Q	67	42
Below median for HC_1Q	33	58

TABLE 2.7

Reported Use of Baby Foods Other Than Milk, and Age of Infant at Introduction of Foods: Children Compared According to Current Head Head Circumference Quotient (HCQ)

	Index		Control	
	Below[1]	Above	Below[1]	Above
Strained baby foods:				
Meats, eggs, poultry				
% reported	50%	77%	77%	71%
Age at introduction	1½-12 mo	1-3 mo	0-6 mo	1-10 mo
Fruits and vegetables				
% reported	57%	64%	77%	86%
Age at introduction	0-12 mo	1-5 mo	0-6 mo	1-10 mo
"Junior" foods				
% reported	21%	31%	31%	36%
Age at introduction	9-11 mo	1½-8 mo	1½-6mo	3-5 mo
Juices				
% reported	57%	69%	69%	71%
Age at introduction	0-2 mo	0-3 mo	0-1 mo	0-3 mo
Cereal in bottle				
% reported	43%	77%	69%	57%
Age at introduction	0-2½ mo	0-3 mo	0-1 mo	½-1½ mo
Pre-masticated meats				
% reported	0%	23%	8%	15%
Age at introduction	-	4-5 mo	3-4 mo	5 mo

1 "Below" and "above" refer to children below and above their median for current head circumference quotient.

In general, it seems as if anyone who followed a standardized dietary schedule for their infant simply lacked imagination.

4. Eating Habits of Infants

Tables 2.8 and 2.9 show index and control children ranked according to current head circumference quotient (lowest to highest) and compared in terms of intersensory integration test performance and their mothers' appraisals of their eating habits as infants. It should be noted that all but two of the index children above their median for current head circumference quotient also fall above their median for performance on the intersensory integration test, a relationship which does not hold within the control group.

The eight index children (Table 2.8) with smallest current head circumference quotients also were reported to have had deviant eating habits as infants. Three were on milk exclusively for more than six months (one of these was hospitalized with iron-deficiency anemia), three others were reported to have had little appetite as infants, another preferred milk to the exclusion of other foods, and one infant had food allergies. The child with food allergies ranks above the median in terms of developmental test performance, while the seven others rank below the median, as do five of the six additional index children with relatively small head circumferences but whose eating habits were unremarkable, according to their mothers. No such pattern is observed among control children (Table 2.9).

Altogether, seven infants were described as small, "choicy" eaters, four index children and three controls. Three of the four index children ranked below the median on both parameters, and the fourth ranked above the median on both parameters. Among the three control children, one ranked below the median on both parameters, and two ranked above the median in terms of head circumference quotient, but these two fell on opposite sides of the median for intersensory integration test performance.

The results suggest that head growth of some children who were small newborns may be more susceptible to nutritional stress in early infancy, the effects of which may in turn be reflected in subsequent head size and mental development in childhood. If the data here do not support conclusions, they do reinforce the question.

5. Transition to Table Foods and Self-Feeding

Two milestones in infancy with respect to diet were taken into account. First is the transition to table foods, which marks the departure from the built-in nutritional balance of prepared

TABLE 2.8

Eating Habits of Children as Infants Compared with Current Head Circumference Quotient and Intersensory Integration Test Performance. Index Group.

Rank Position with Respect to Median Value For:		Appetite as Infants			
			Large Appetite		
Current Head Circumference Quotient	Intersensory Integration Test Performance	Not Remarkable	For Milk Only	In General	Small Appetite
Below	Below				X
"	Above	X(1)			
"	Below				X
"	"			X(2)	
"	"		X		
"	"			X(2)	
"	"				
"	"	X(2)			X
"	"	X			
"	"	X			
"	"	X			
"	"	X			
"	"	X			
"	Above	X			
Above	"			X(3)	
"	"	X(3)			
"	"	X(3)			
"	"				X(1)
"	Below			X(4)	
"	Above	X			
"	Below	X			
"	Above	X			
"	"	X			
"	"	X			
"	"			X	
"	"	X			
"	"	X			
"	"		X		

(1) Food allergies
(2) Prolonged milk regimen
(3) Premasticated food
(4) Given sugar water

TABLE 2.9

Eating Habits of Children as Infants Compared with Current Head Circumference Quotient and Intersensory Integration Test Performance. Control Group.

Rank Position with Respect to Median Value For:		Appetite as Infants			
			Large Appetite		
Current Head Circumference Quotient	Intersensory Integration Test Performance	Not Remarkable	For Milk Only	In General	Small Appetite
Below	Below	X			
"	Above	X			
"	Below				X
"	"	X			
"	Above	X			
"	Below	X			
"	"	X			
"	"		X		
"	Above	X			
"	"	X(1)			
"	"	X			
"	"	X			
"	Below	X(3)			
"	"	X			
Above	"			X(2)	
"	Above				X
"	"	X			
"	"	X			
"	Below	X			
"	"	X			
"	Above			X(3)	
"	Below	X(3)			
"	Above			X(1)	
"	"	X			
"	Below				X
"	"			X	
"	"			X	
"	Above			X(4)	

(1) Didn't like baby food. Started on table food at 2 months
(2) Prolonged milk regimen
(3) Premasticated food
(4) Especially meats

infant foods and the greater attention to infant diet which may be associated with special baby foods, and second is the point where infants are no longer fed by an older person, and they may therefore select from available foods with relative autonomy.

In the timing of these two events, the range of variation was great. Table 2.10 shows that, as might be expected, infants were on table foods before they were "on their own." However, no pattern is observed between head growth and either of these two events, for the index or the control group.

Section D. Childhood Environment

Index and control children are classified according to current height quotient and compared in Table 2.11. Although index children are underrepresented among the taller children (i.e., those with current height quotients greater than 110), there is no significant difference between the mean height quotients of the two groups ($t = 1.58$, $> .10$). Since the two groups by middle childhood are not significantly dissimilar, they are combined in this section.

On the basis of weight-height ratios[12] as an index of nutritional status, the tallest children are better nourished than the shortest (current height quotient less than 90) children. Mean weight-height ratios were 23.3 and 18.9 respectively. Another index of nutritional status, mean arm circumference/chronological age, for the same groups of children were 2.5 and 2.0, respectively, further indicating that linear growth has been accompanied by an even greater relative accumulation of body mass.[13]

Analysis of the data on the childhood period centered around two questions: (1) to what extent is nutrition related to differential growth in this population?; (2) what other environmental factors emerge in association with the child's growth and/or diet?

1. Diet and Growth

The total protein and caloric value of each child's food intake on a weekday[14] were calculated.[15] Mean intake for all children was 1634 calories and 55.3 grams protein (with index children faring better than the control group, see Table 2.12). Intakes were categorized as "adequate" or "inadequate", using as guidelines the Recommended Daily Dietary Allowances prepared by the Food and Nutrition Board of the National Research Council. "Inadequate" calories were defined as less than 1990[16], and "inadequate" protein as less than 40 grams.

As might be expected, given American dietary habits, no child reported an intake which was "inadequate" in protein but "adequate" in calories. Mean current height quotients were calculated for the three other possibilities ("adequate" protein and "adequate" calories, "adequate" protein but "inadequate" calories, and "inadequate" amounts of both protein and calories), and data are

TABLE 2.10

Mean Age at Which Infants Were Eating Table Foods Exclusively and Mean Age at Which They Were Feeding Themselves, According to Current Head Circumference Quotient (HC_1Q): Index and Control Children Compared

	Index	Control
Table Foods		
HC_1Q below the median	.98 years	.96 years
HC_1Q above the median	1.05	1.06
Self-feeding		
HC_1Q below the median	1.81	1.16
HC_1Q above the median	1.39	1.52

TABLE 2.11

Distribution of Current Height Quotients[(a)] of Study Children: Index and Control Groups Compared

Height Quotient	Number of Children	
	Index	Control
Less than 90	5	5
Between 90 and 110	20	12
Greater than 110	3	11

(a) Height quotient = Height age/Chronological age X 100. Height-age based on U.S. Department of Health, Education and Welfare, National Center for Health Statistics, 1970, Tables 10 and 11.

TABLE 2.12

Mean Daily Intake of Protein and Calories, Index Children, Control Children and All Children (1)

Group	Protein	Calories
Index	60.7 gm.	1687
Control	50.0	1581
Total, All Children	55.3	1634

(1) Based on 24-hour recall method, children interviewed

provided in Table 2.13.

The range of height quotients within each cell was considerable, due to the many extra-nutritional factors which also influence height, as well as the fact that no single day's intake is necessarily "typical" of the other days, for any child. However, at the aggregate level, mean height quotients do follow the expected pattern: 106.1 among children whose intakes during the reference day were "adequate" in both protein and calories; 101.1 among children whose intakes were "adequate" in protein, but "inadequate" in calories, and 97.2 among children whose intakes were "inadequate" in both nutrients. Despite the influence and interaction of many genetic and other environmental factors, for this study population, protein-calorie intake and physical growth are related.

2. Family Resources

Since food obviously has to be transported to the home and usually paid for, tabulations were made relating children's diets and growth to the availability of these ancillary resources, with attention also to their affect on the family's decision-making with respect to patterns of food acquisition.

a. Private transportation in the family. One family in five did not have a private means of transportation, and the lack of it clearly affects food-shopping decisions and shopping patterns (Table 2.14), which in turn are associated with differences in growth (Table 2.15).

Families with private means of transportation usually shop once a week, while those without transportation shop either more than once a week, or less than once. The usual distance between home and food store is one to five miles, although one-third of families with private means of transportation do their main food shopping more than five miles from home. Among families with private means of transportation, distance from home for food shopping is positively associated with height quotient, and frequency of food shopping is negatively associated with height quotient. Corresponding patterns among families without private means of transportation were not clear, but cell sizes were also small.

Among families with private means of transportation, intake of protein and calories of their children was not associated with either shopping distance or shopping frequency, although children of the once-a-week shoppers have the highest mean intake of protein and calories (Table 2.16). Among families without private means of transportation, the further from home the food stores patronized and the less frequent the food-shopping expeditions, the greater the mean dietary intake of the child, but again, cell sizes were small.

TABLE 2.13

Mean Current Height Quotients of Children According to "Adequacy" of Protein and Calorie Intake(1)

		Calories	
		"Adequate"	"Inadequate"
Protein	"Adequate"	106.1	101.1
	"Inadequate"	-	97.2

(1) Based on 24-hour recall method. Reference day was a school day. "Adequacy" was defined as more than 1990 calories and more than 40 grams protein.

TABLE 2.14

Distribution of Children According to Food Shopping Patterns and Mode of Transportation of their Families

		Shopping Distance(1)			
		< 1 mi.	1-5 mi.	> 5 mi.	Total
Shopping Frequency	> 1 Time Per Week	1	5	6	12
	1 Time Per Week	2	16	7	25
	< 1 Time Per Week		4	1	5
	Total	3	25	14	42

(1) Children of families with private transportation

		Shopping Distance (2)			
		< 1 mi.	1-5 mi.	> 5 mi.	Total
Shopping Frequency	> 1 Time Per Week	1	3		4
	1 Time Per Week		2		2
	< 1 Time Per Week		4	1	5
	Total	1	9	1	11

(2) Children of families without private transportation

TABLE 2.15

Mean Height Quotients of Children According to Food Shopping Patterns and Mode of Transportation of their Families

		Shopping Distance (1)			
		< 1 mi.	1-5 mi.	> 5 mi.	
Shopping Frequency	> 1 Time Per Week	82.7	99.7	101.6	99.2
	1 Time Per Week	96.6	100.6	106.8	102.0
	< 1 Time Per Week		99.0	119.5	103.1
		91.9	100.2	105.5	101.3

(1) Children of families with private transportation

		Shopping Distance (2)			
		< 1 mi.	1-5 mi.	> 5 mi.	
Shopping Frequency	> 1 Time Per Week	70.5	97.3		90.6
	1 Time Per Week		120.1		120.1
	< 1 Time Per Week		109.2	81.5	103.7
		70.5	107.7	81.5	101.9

(2) Children of families without private transportation

TABLE 2.16

Mean Grams Protein (P) and Calorie Intake (C) in a Day[1] of Children According to Food Shopping Patterns and Mode of Transportation of Their Families

		Shopping Distance[2]			
		< 1 mi.	1-5 mi.	> 5 mi.	
Shopping Frequency	> 1 Time Per Week	P: 78.8 gms C: 1589	P: 46.9gms C: 1381	P: 56.7gms C: 1842	P: 54.3gms C: 1610
	1 Time Per Week	P: 55.8 C: 1565	P: 57.8 C: 1569	P: 68.3 C: 2006	P: 60.4 C: 1686
	< 1 Time Per Week		P: 50.9 C: 1961	P: 33.0 C: 1630	P: 46.4 C: 1878
		P: 63.5 C: 1573	P: 54.8 C: 1579	P: 61.1 C: 1914	P: 57.4 C: 1685

		Shopping Distance[3]			
		< 1 mi.	1-5 mi.	> 5 mi.	
Shopping Frequency	> 1 Time Per Week	P: 33.5 C: 1380	P: 36.5 C: 1019		P: 35.8 C: 1109
	1 Time Per Week		P: 52.4 C: 1242		P: 52.4 C: 1242
	< 1 Time Per Week		P: 53.8 C: 2065	P: 86.4 C: 1992	P: 60.3 C: 2050
		P: 33.5 C: 1380	P: 47.7 C: 1533	P: 86.4 C: 1992	P: 50.0 C: 1561

(1) Based on 24-hour recall
(2) Children of families with private transportation
(3) Children of families without private transportation

These data indicate that the presence or absence of a private mode of transportation within the family affects shopping patterns, which in turn may influence the nutritional environment and growth of the child. Most supermarkets in Kansas City, Kansas have special parking areas reserved for cab stands, and, with rapid transit of inferior quality and quantity, and high in price, a private means of transportation is essential for the optimal use of one's financial resources. Food distributed to "ghetto" supermarkets is notoriously inferior-for-the-price, thus providing those with private means of transportation a decided advantage in terms of stretching their food dollar.

Transportation touches many facets of a child's enviroment. It affects not only his food supply, but the quality of his medical attention, his opportunities for participation in sports and recreational events, and myriad other stimulating and essential childhood experiences. Lack of it can affect a child's school participation, and he and his family are certainly more vulnerable to the stress of weather. The effect of transportation on a child's total, as well as nutritional environment, needs much more exploration.

None of the above would be news to a resident of the Northeast area. "Getting there" is a daily hassle, affecting responses to emergencies as well as a host of less urgent decisions.[17]

b. Money. The amount of money available and used for food in every family is a function not only of income, but of food priorities in competition with money desired for many non-food commodities and services, seasonal and non-seasonal, as well as money required for obligations such as rent, telephone, utility bills, credit payments, or unexpected contingencies, and each family has its own formula for reconciling these factors. However, two questions were asked in order to get some information on the possible relationship of the money supply to the food supply and/or its association with child growth: (1) "Does most of the money for this household come in once a month, every two weeks, every week or at different times?" (2) "Do you eat differently when your money comes in compared to the rest of the time?"

The results of informants' responses are given in Tables 2.17 and 2.18. The data suggest that dietary intake is positively associated with the frequency of pay periods (Table 2.18, whereas growth differences in children are associated with the extent to which the event, payday, changes food patterns (Table 2.17).

The group of tallest children (height quotient 107.1) live in homes with a weekly income and where payday means a trip out for a meal. On the average, children in homes with a weekly income fare better than the others, in terms of both diet and growth,

TABLE 2.17

Mean Height Quotients (HQ) and Weight-Height Ratios (W/H) of Children According to Frequency of Family Income Receipts and Effect (if any) of Payday on Food Patterns(1)

		Frequency of paydays				
		Once a Month	Every 2 Weeks	Every Week	Different Times	
Food Patterns	No Change	HQ:103.6 W/H:21.6 (7)	HQ:101.2 W/H:22.2 (12)	HQ:102.8 W/H:21.4 (16)	HQ:102.6 W/H:19.5 (3)	HQ:102.4 W/H:21.6 (38)
	Change: Eat Out Only	HQ:110.6 W/H:21.5 (2)		HQ:107.1 W/H:23.4 (3)	HQ:82.7 W/H:17.1 (1)	HQ:104.2 W/H:21.7 (6)
	Change: Shop for Different Foods	HQ:95.9 W/H:21.1 (6)	HQ:100.5 W/H:18.0 (2)	HQ:99.0 W/H:20.4 (2)		HQ:97.4 W/H:20.3 (10)
		HQ:101.4 W/H:21.4 (15)	HQ:101.1 W/H:21.6 (14)	HQ:103.1 W/H:21.6 (21)	HQ:97.7 W/H:18.9 (4)	HQ:101.7 W/H:21.4 (54)

(1) Number of observations in each cell is shown in the lower right-hand corner of the cell.

TABLE 2.18

Mean Protein (P) and Calorie (C) Intake[1] of Children According to Frequency of Family Income Receipts and Effect (if any) of Payday on Food Patterns[2]

		Frequency of paydays				
		Once a Month	Every 2 Weeks	Every Week	Different Times	
Food Patterns	No Change	P:43.0 C:1173 (7)	P:61.2 C:1760 (12)	P:66.0 C:1793 (15)	(2)	P:58.6 C:1626 (36)
	Change: Eat Out Only	P:42.4 C:1302 (2)		P:55.0 C:2140 (3)	P:78.8 C:1589 (1)	P:54.8 C:1769 (6)
	Change: Shop for Different Foods	P:54.7 C:1598 (6)	P:45.0 C:1324 (2)	P:80.8 C:2202 (2)		P:58.0 C:1664 (10)
		P:47.6 C:1360 (15)	P:58.9 C:1698 (14)	P:65.9 C:1886 (20)	P:54.5 C:1300 (3)	P:58.1 C:1650 (52)

(1) Based on 24-hour recall interviews with children
(2) Number of observations in each cell is shown in the lower right-hand corner of the cell.

while the group of children with the lowest mean height quotient (95.9) live in homes where money comes in only once a month and the food supply goes through a corresponding monthly cycle.[18]

The fact that frequency of paydays shows no consistent association with growth would be expected, because job tenure is not secure for this population in general. Job changes, as well as the periodic state of being unemployed, which are common events in many households, will often be accompanied by changes in the frequency with which money comes into a household.

The fact that food patterns show no consistent association with mean protein and calorie intake may be attributed to the fact that, in scheduling our dietary interviews, we did not anticipate the need to control for the position of our interview-reference day relative to the time of the previous and next payday. In retrospect, we wish we had asked about that.[19]

c. Commodities or food stamps. One third of sample families were receiving commodities or food stamps,[20] and Table 2.19 shows the tabulation of growth and dietary data of children according to the family's participation or non-participation in a food supplement program.

Children of participants had a higher mean height quotient and weight-height ratio, but differences were statistically significant only for the weight-height ratios ($t = 6.3$, $p < .01$). Children of non-participants had higher mean protein and calorie intakes. Differences in mean calorie intake are significant ($t = 4.6$, $p < .01$).[21]

d. Home-produced food. The Northeast area is a relatively green ghetto, although not uniformly so. While many sections are well manicured, the "projects" are practically barren.

Many black families came out of a southern rural tradition, and it shows in their skill as gardeners, although those who have a long history in Kansas City, Kansas also know very well what to do with a piece of land. Older people are usually the inveterate gardeners, but also in younger households those who have space will often plant at least tomatoes and greens. Forty per cent of the sample families grew some of their food during at least one of the past two growing seasons surveyed.

Table 2.20 shows that home production of food is not reflected in child growth differences, but it is positively associated with dietary intakes. However, considering the small scale of the gardening, it is unlikely that this is related directly to home-grown food as a factor in the total food supply, although it may

TABLE 2.19

Growth and Dietary Characteristics of Children According to Household Participation or Non-Participation in a Food Supplement Program

	HQ	Wt/Ht	Protein	Calories
Participants (17)	102.5±10.1	22.1±3.0	48.1±11.8	1522±598
Non-participants (36)	101.6±13.3	21.0±2.8	57.4±22.9	1675±491

TABLE 2.20

Growth and Dietary Characteristics of Children According to Whether Households Produced Any of Their Own Food

			Have a Garden This Year?		
			Yes	No	
Last Year	Yes	HQ[1]	100.4	100.8	100.5
		W/H	21.2	21.6	21.3
		Pro.	66.4	41.3	61.1
		Cal.	1699	1572	1761
	No	HQ	97.8	102.0	101.4
		W/H	19.8	21.5	21.2
		Pro.	65.6	49.9	52.2
		Cal.	1782	1529	1565
		HQ	99.8	101.8	101.0
		W/H	20.9	21.5	21.3
		Pro.	66.2	48.9	55.3
		Cal.	1804	1534	1634

(1) HQ = Height Quotient; W/H = Weight-Height Ratio; Pro. = Protein intake on one weekday, based on 24-hour recall; Cal. = Caloric intake on the same day

reflect a family's degree of attention to food as an important commodity.

Of course, many families which do not grow food may nevertheless care about food. Several preconditions, especially land and human energy, must be right for gardening. Moreover, these conditions can and often do change for area residents from year to year.

3. Household Composition.

Households of sample children varied in terms of composition, and tabulations have been made to determine whether this variability is reflected in differences in the growth and dietary intakes of sample children.

Three features of household composition are tabulated: presence of father (including a social father if his role goes back to the child's early infancy); size of the sibship and birth order of propositus within the sibship; and number of residents in the household.

a. Presence of father. During the interviewing, when the subject of meal preparation was discussed, divorced and widowed women usually said they do not go to as much trouble in food preparation now as they had when their husbands were present, and the dietary data in Table 2.21 support this. Corresponding differences in growth patterns of children are not apparent among children of widowed or divorced mothers. However, changes in marital status are relatively recent, so that it may be too soon for any possible effects on growth to be manifest. Child growth is similar among children, regardless of whether a father is or has been at the home.

The dietary data for children in households with fathers continuously absent are intermediate between those households with fathers present and those where family life has been disrupted by divorce or the father's death.

It would appear, on the basis of the data, that it is the stability of family composition, in terms of fathers' continuous presence or continuous absence, which is more important to diet than the presence or absence of the father per se. Several women who had never been married expressed their impatience with the stereotypic view of the fatherless household, and the data seem to bear them out.

However, the presence of a father does make a difference in home food production. Sixteen of the 21 households which grew some of their own food in summer 1973 included fathers, while only 12 of 31 households which were not gardening during that period had fathers at home. Fathers prepare the ground for sowing, as a minimum, although some work in the garden through all phases.

TABLE 2.21

Growth and Dietary Characteristics of Children According to Presence or Absence of Father[1] in the Household

	Mean Height Quotient	Mean Wt/Ht Ratio	Mean Protein Intake[2]	Mean Calorie Intake[2]
Father continuously present (28)[3]	100.4	21.4	62.7gm	1789
Father deceased or parents divorced (18)	101.7	21.1	43.7	1440
Father continuously absent (10)	101.5	21.2	55.2	1545

(1) Or social father, if his role goes back to the child's early infancy
(2) Based on 24-hour recall, children interviewed
(3) Figures in parentheses refer to number of observations in that category

b. Sibship size and child's ordinal position in the sibship. Median sibship size was between four and five; the range was from one to eleven. Data were tabulated for small sibships (1-3 children), medium-sized (4-5 children), and large sibships (6 or more children).

Mean height quotients and weight-height ratios decreased as sib size increased (Table 2.22). Children from the smaller sibships were considerably taller than those from larger sibships, although mean weight-height ratios were only slightly larger. Protein and calorie intakes actually increased slightly with sibship size (Table 2.23).

When data are cross-tabulated according to the child's ordinal position within the sibship (the categories are: first-born, middle children and last-born), the decrease in mean height quotient as sibship size increases persists, but also the last-born (i.e., youngest members of their sibships) have even higher mean height quotients than their peers who have younger brothers and sisters. The first-born maintain a mean height advantage over the middle-born in small sibships, but fall behind the middle-born as sibship size increases.[22] Patterns in mean weight-height ratios are not consistent when birth order is taken into account, nor are protein and calorie intake.

c. Household size. Data on growth and dietary intakes of sample children according to the size of households in which they live are given in Table 2.24. Size of household ranged from three to eighteen, with the median between six and seven persons. No marked difference is observable between children in households above the median and those below, although the small difference is in the expected direction for dietary, as well as growth, parameters.

In summary, among the family-structural aspects of a child's environment, marital dissolution, due either to death or divorce, would appear to be more disruptive to the child's diet than the continuous absence of a father in the home. Moreover, the presence or absence of a father does not seem to be associated with growth, and only marginally with diet. Sibship size is negatively associated with growth, but positively associated with protein and calorie intake.

Birth order seems to be very important, with the "babies" of families at a decided growth advantage over their age mates who have younger sibs. First-borns in small families also grow impressively, although not as well as their last-born age mates in the largest families. The data suggest that ordinal position within the sibship may be more important for a child's growth than the actual size of the sibship itself.

TABLE 2.22

Mean Height Quotients (HQ) and Weight-Height Ratios (W/H) of Sample Children, According to Sibship Size and Each Child's Ordinal Position Within the Sibship

		Ordinal Position			
		First Born	Middle Born	Last Born	
Sibship Size	1 - 3 Children	HQ:103.6 W/H:20.2	HQ:100.6 W/H:19.0	HQ:105.9 W/H:24.4	HQ:104.2 W/H:21.8
	4 - 5 Children	HQ:96.6 W/H:21.3	HQ:98.4 W/H:21.7	HQ:105.5 W/H:20.5	HQ:100.3 W/H:21.3
	6+ Children	HQ:81.5 W/H:19.6	HQ:97.5 W/H:20.7	HQ:104.3 W/H:20.4	HQ:98.2 W/H:20.6
		HQ:100.8 W/H:20.4	HQ:98.2 W/H:21.1	HQ:105.4 W/H:24.1	

TABLE 2.23

Mean Protein (P) and Calorie (C) Intakes[1] of Sample Children, According to Sibship Size and Each Child's Ordinal Position Within the Sibship.

		Ordinal Position			
		First Born	Middle Born	Last Born	
Sibship Size	1 - 3 Children	P: 46.4 C: 1352	P: 88.2 C: 1186	P: 55.2 C: 1893	P: 49.9 C: 1563
	4 - 5 Children	P: 46.4 C: 1961	P: 53.7 C: 1488	P: 57.9 C: 1828	P: 54.2 C: 1637
	6+ Children	P: 86.4 C: 1992	P: 59.7 C: 1690	P: 47.8 C: 1426	P: 58.2 C: 1642
		P: 49.8 C: 1507	P: 52.9 C: 1480	P: 54.5 C: 1763	

(1) Based on 24-hour recall, children interviewed

TABLE 2.24

Mean Height Quotients, Weight-Height Ratios and Protein and Calorie Intakes[1] of Children, According to the Total Number of Persons in Their Respective Households

Household Size	HQ	Wt/Ht	Protein	Calories
Six persons or less (27)	102.1	21.4	55.5gm	1679
Seven persons or more (28)	100.3	21.1	51.9[2]	1542[2]

(1) Based on 24-hour recall, children interviewed
(2) N = 26

Finally, total household size *per se* turned out to be a relatively unimportant factor in both growth and dietary differences.

4. Residential Stability.

Changes in residence were reconstructed back to the gestational period of each sample child, and reasons for moves were recorded. Some families move because they want to, others because they have to; some children have grown up in the same house while others' families have moved frequently. Data on these patterns were tabulated for possible associations with growth and/or diet.

The motivation for each move was classed as "positive" or "negative." Positive factors are those which involve attraction to more desirable living quarters, and such moves are usually accompanied by an improvement in living conditions. Examples include : "We decided to buy a house" or "That place was too small after Junior was born." Negative factors are those which involve either the decision to move away from an undesirable dwelling, or necessity on account of urban renewal, or eviction, or in the case of home owners, foreclosure ("We lost that house."). The most common complaint among renters was refusal of the landlord to make repairs. Negative moves are sometimes accompanied by an improvement in housing, but frequently, the problems which the move was designed to alleviate, reappear.[23]

It was necessary to have a third category, for families which, over the years, have moved sometimes for positive and sometimes for negative reasons. Included also in this category were households where the child and his mother have continued to live with her parents, on the assumption that the fact of their remaining in the parental home is due to inertia or at least the absence of either positive or negative forces.

Table 2.25 shows that people who move for positive reasons move less often than those who move for negative reasons.

Children in families who always moved for positive reasons have higher height quotients than those of families who always moved for negative reasons ($t = 2.08$, $p < .05$: see Table 2.26). Children whose families had moved only once or not at all, in six years, have higher mean height quotients than those whose families had moved 2 or more times in six years, but the "t" scores were not significant. It would appear that motivation for the move is more strongly associated with height differences than the total number of moves. Similar patterns are observed for weight-height ratios, but differences between those means were not significant. No consistent patterns are observed for protein or calorie intakes (Table 2.27).

TABLE 2.25

Distribution of Sample Families According to the Number of Residential Moves in the Past Six Years and Reasons for the Moves

		Reasons for move			
		Positive	Positive and Negative	Negative only	
Number of Moves in Six Years	0	12	3	-	15
	1	15	-	4	19
	2	5	-	6	11
	3	1	4	3	8
	more than 3	-	2	1	3
		33	9	14	56

TABLE 2.26

Mean Height Quotients (HQ) and Weight-Height Ratios (W/H) of Children According to the Number of Residential Moves of the Household in the Past Six Years, and Reasons for the Moves

		Reasons for Move			
		+	+ & -	-	
Number of Moves in Six Years	0	HQ:103.9 W/H:21.7	HQ:102.8 W/H:21.5		HQ:103.7 W/H:21.7
	1	HQ:104.9 W/H:22.0		HQ:101.0 W/H:21.3	HQ:104.1 W/H:21.9
	2	HQ:103.2 W/H:22.0		HQ:91.4 W/H:19.3	HQ:96.8 W/H:20.5
	3	HQ:93.4 W/H:20.5	HQ:89.3 W/H:19.7	HQ:101.5 W/H:19.8	HQ:94.4 W/H:19.8
	More than 3		HQ:106.6 W/H:19.1	HQ:93.3 W/H:28.4	HQ:102.2 W/H:22.2
		HQ:103.9 W/H:21.8	HQ:95.1 W/H:19.5	HQ:97.6 W/H:20.8	HQ:101.0 W/H:21.3

TABLE 2.27

Mean Protein (P) and Calorie (c) Intakes[1] of Children According to the Number of Residential Moves of the Household in the Past Six Years and Reasons for the Moves

Number of Moves in Six Years	Reasons for Move: +	+ & -	-	
0	P: 59.9 C: 1722	P: 76.1 C: 2100		P: 63.1 C: 1797
1	P: 54.4 C: 1473		P: 41.7 C: 1253	P: 52.2 C: 1521
2	P: 46.1 C: 1664		P: 67.5 C: 1814	P: 57.7 C: 1746
3	P: 24.0 C: 1250	P: 56.2 C: 1656	P: 46.1 C: 1439	P: 48.4 C: 1524
More than 3		P: 41.5 C: 1182	P: 48.4 C: 1672	P: 43.8 C: 1345
	P: 54.2 C: 1635	P: 51.3 C: 1498	P: 59.0 C: 1683	P: 55.3 C: 1576

(1) Based on 24-hour recall, children interviewed.

Data on the length of tenure at the latest address, also tabulated for associations with growth and diet, are shown in Table 2.28. Trends over the three categories, for all parameters, are in a consistent direction, although the variances are high.

5. Factors Intrinsic to the Mother

Within certain limitations, many of which have been explored above, a child's nutritional environment also depends upon which mother he has, her attitudes toward and training in cooking, and her knowledge of nutrition, as well as her motivation to optimize her resources.

a. Attitudes, training and knowledge. It might be expected that the way in which a mother learned to cook, her attitudes toward cooking, and her knowledge of nutrition could affect her child's nutrition and growth. Four questions in this area were asked: (1) Do you like to cook? (2) How did you learn to cook? (3) Do you always prepare a well-balanced meal? (4) Do you know of any foods which will keep a child healthy? Responses are tabulated in Tables 2.29 through 2.32, with corresponding means for height quotient, weight-height ratio, and protein and calorie intake.

In order to be placed in the category "like to cook" (Table 2.29), a mother had to wax enthusiastic during the interview, while the middle category includes mothers who expressed at least a willingness to do their "duty": "I have to like to cook, with all these kids!" or "I don't mind cooking, but it's not my favorite." The "no" category includes only unequivocal negative responses, and is reflected in the height quotients, and protein and calorie intakes of their children, while children whose mothers are in the other two categories are more similar.

The vast majority (78 per cent) of women learned to cook at their childhood homes, either from their mothers or from other relatives who lived and cooked there, although mothers often did not have major cooking responsibilities until they were out on their own (Table 2.30). A few women learned to cook from their husbands and/or their husbands' relatives.

Children of mothers who described themselves as "self-taught" have the lowest means for child growth and the dietary data, while children of women who learned to cook in school or by using cookbooks show the greatest average growth, although they have only a slight edge in the dietary data.

Nutritional knowledge may or may not be utilized, and an attempt was made to partition out the effects of knowledge by tabulating each mother's appraisal of the nutritional quality of her meals against her responses to the question of what foods will keep a child healthy.[24]

TABLE 2.28

Mean Height Quotients, Weight-Height Ratios and Protein and Calorie Intakes of Children According to Household Tenure at Present Residence

Number of Years	Height Quotient	Weight Quotient	Protein Intake	Protein Intake
Less than 1 year	95.5	20.6	45.2	1475
More than 1 year but less than 6 years	101.8	21.3	51.9	1609
More than 6 years	103.7	21.7	63.1	1797

TABLE 2.29

Mean Height Quotients, Weight-Height Ratios and Protein and Calorie Intakes of Children According to Mothers' Attitudes Toward Cooking

	Height Quotient	Weight ÷ Height	Protein Intake	Calorie Intake[a]
Likes to cook (26)[b]	102.5	21.7	61.3[c]	1693[c]
So-so, "sometimes" and indefinite responses (14)	102.7	20.9	57.7[d]	1731[d]
"No" - don't like to cook (14)	99.2	21.1	49.2	1497

(a) Based on 24-hour recall, children interviewed
(b) Figures in parentheses refer to the number of mothers in that category
(c) N = 25
(d) N = 13

TABLE 2.30

Mean Height Quotients, Weight-Height Ratios and Protein and Calorie Intakes of Children, According to How Their Mothers Learned to Cook

	Height Quotient	Weight ÷ Height	Protein Intake	Calorie Intake
School and/or Cookbooks	106.2	23.3	57.8	1812
At Childhood Home	102.0	21.3	57.6	1682
Mainly "Self-Taught"	96.7	20.1	46.5	1350

Height quotients for children of mothers who said the meals they prepared were not well-balanced, and of mothers who did not know what foods would keep a child healthy or who did not connect food with the well-being of their children, were generally lower than height quotients for children of mothers who belong to the other categories (Table 2.31).[25] Aside from the extreme cases, relationships between a mother's nutritional knowledge and child growth, or mothers' apparisals of the nutritional quality of meals and child growth, could not be found. Moreover, weight-height ratios show no patterns, nor do mean dietary intakes (Table 2.32).

It may be that our open, general questions were poor discriminators, or perhaps questions made mothers feel defensive and unwilling to respond honestly.[26] Or, it may be that these factors are simply outweighed by other, extrinsic factors in the environment, factors beyond the control of mothers, no matter how knowledgeable and dedicated they may be. Whatever the reasons, these data fail to support the common notion that nutritional knowledge affects meal planning, diet or child growth, except in extreme cases of ignorance or an acknowledged failure, on the part of mothers, to provide well-balanced meals.

b. Motivation. Although motivation on the part of heads of households to provide for the family may be an important feature of every child's environment, it is difficult to evaluate empirically. A modest approach in this direction was made through the inclusion, on the questionnaire, of questions on whether or not a household head patronizes specialty shops for any of the food supplies. The rationale was that, since supermarkets contain all the food items which any household would need, the use of any other type of food shop constitutes discrimination on the part of the shopper as to quality or price, with respect to the acquisition of some food items. This type of concern was interpreted as a form of motivation.[27]

Table 2.33 shows mean growth and dietary data for sample children tabulated according to whether or not specialty food shops are patronized by the heads of their households.[28] Growth differences in children are not associated with use or non-use of specialty food shops, although mean protein and calorie intakes of children are higher in those households which shop outside the supermarket for at least part of their food.

6. Factors Intrinsic to the Child.

To a certain extent, a child's diet is regulated by the child, in that he can reject what is available. Two questions were asked, in an attempt to appraise the eating habits in households and ultimately those of propositus: (1) Do you have any fussy eaters in the family? (2) Do you have any big eaters?

TABLE 2.31

Mean Height Quotients and Weight-Height Ratios of Children According to Whether or Not Their Mothers Report Preparing Well-Balanced Meals and What Foods Mothers Think Will Keep a Child Healthy

		"Well-Balanced" Means Prepared?			
		"Yes" and "I try"	Qualified "Yes", "Sometimes", Usually","Not always", and "When I cook"	"No" and "Don't know"	
	"Balanced Diet	HQ: 97.4 W/H: 19.6			HQ: 97.4 W/H: 19.6
Number of Food Groups Mentioned As Keeping a Child Healthy	3 & 4 food Groups	HQ: 101.7 W/H:21.5	HQ: 99.1 W/H:20.9		HQ: 100.7 W/H: 21.3
	Two food Groups	HQ: 102.4 W/H: 22.9	HQ: 114.0 W/H: 20.6	HQ: 82.4 W/H: 17.8	HQ: 104.6 W/H: 21.7
	One Food Group	HQ: 100.9 W/H: 21.5	HQ: 106.9 W/H: 20.5	HQ: 93.1 W/H: 21.6	HQ: 102.9 W/H: 21.1
	"Don't know" and "No"	HQ: 99.1 W/H: 20.5	HQ: 93.3 W/H: 28.4	HQ: 99.1 W/H: 22.3	HO: 98.7 W/H: 21.7
		HQ: 100.5 W/H: 21.3	HQ: 105.8 W/H: 21.1	HQ: 95.8 W/H: 21.6	HQ: 101.4 W/H: 21.3

TABLE 2.32

Mean Protein (P) and Calorie (C) Intakes of Children According to Whether or Not Their Mothers Report Preparing Well-Balanced Meals and What Foods Mothers Think Will Keep a Child Healthy

		"Well-Balanced" Means Prepared?			
		"Yes" and "I try"	Qualified "Yes", "Sometimes", "Usually", "Not always", and "When I cook"	"No" and "Don't know"	
	"Balanced Died"	P: 48.6 C: 1341			P: 48.6 C: 1341
Number of Food Groups Mentioned As Keeping a Child Healthy	3 & 4 Food Groups	P: 76.2 C: 1861	P: 37.7 C: 1172		P: 62.2 C: 1611
	Two Food Groups	P: 58.2 C: 1909	P: 47.0 C: 1412	P: 43.5 C: 1393	P: 53.3 C: 1701
	One Food Group	P: 62.1 C: 1836	P: 47.0 C: 1499	P: 47.7 C: 1638	P: 54.6 C: 1678
	"Don't know" and "No"	P: 54.1 C: 1656	P: 48.4 C: 1672	P: 58.3 C: 1660	P: 55.4 C: 1659
		P: 61.1 C: 1759	P: 44.6 C: 1400	P: 54.6 C: 1619	P: 55.6 C: 1639

TABLE 2.33

Mean Height Quotients, Weight-Height Ratios, and Protein and Calorie Intakes of Children, According to the Household Head's Use or Non-use of Specialty Food Shops

Household's use or non-use of a specialty shop or milkman	Height Quotient	Weight-Height Ratio	Protein Intake	Calorie Intake
Use (27)[a]	101.7	21.3	67.9[b]	1915[b]
Do not use (26)	100.9	21.5	45.1	1411

(a) Figures in parentheses refer to the number of households
(b) N = 25

Where there were differences within the family, mothers identified individuals and, from this data, each sample child could be classified as:

a) a big eater who likes everything
b) a big eater when offered something he likes
c) a child with average appetite and average tastes
d) a child with less appetite who is more fussy about what he eats

The "fussy" children were much shorter than those in the other three categories (mean height quotient: 96.9, see Table 2.34), although weight-height ratios were similar for all groups. Protein intake did not follow expected patterns, because the "average" children consumed less protein than the "fussy" children. Calorie intake was lowest for the "fussy" group.

Mothers were also asked: "Is there a time of the day when (propositus) is usually the most hungry?" Only three children were hungriest in the morning -- all "big eaters." Twenty per cent of the children were described as "hungry all the time," and their mean protein intake was highest, although mean calories were only second highest (Table 2.35). Almost half of the children were said to be hungriest after school,[29] and they were, by a small margin, the shortest of all groups.

In general, comparisons of children's food idiosyncracies and appetites with their diets and growth were disappointing. Of course, children's habits and preferences may change over time and vary according to the context in which food is provided. Some parents and children just "eat when we're hungry", and possibly some mothers were not as well informed of their children's eating patterns as they thought they were. In retrospect, considering the large amount of daily variability in eating which was observed, our data were too limited to adequately test the role of the child in his own diet.

TABLE 2.34

Mean Height Quotients, Weight-Height Ratios, and Protein and Calorie Intakes [1] of Children According to Their Attitudes Toward Eating

	Height Quotient	Weight ÷ Height	Protein Intake	Calorie Intake
Big Eaters	100.4	21.4	56.4	1707
Big Eaters When They Like What's To Eat	104.5	21.6	59.9	1736
Average Eaters	108.4	21.3	45.5	1543
"Choicy"	96.9	21.0	52.6	1477

(1) 24-hour recall, children interviewed

TABLE 2.35

Mean Height Quotients, Weight-Height Ratios, and Protein and Calorie Intakes (1) of Children According to the Time of Day They Were Reported to be Most Hungry

Most Hungry	Height Quotient	Weight ÷ Height	Protein Intake	Calorie Intake
Mornings	105.0	21.6	44.2	1442
Lunch time	107.4	22.8	57.8	2021
After school	99.6	20.8	52.7	1468
Dinner time	101.2	20.5	44.9	1512
After dinner	102.9	22.4	51.2	1700
All the time	101.3	21.8	66.2	1950
"Never too hungry"	115.7	21.3	43.7	1455
"Eats more on weekends"	105.5	21.7	41.2	1150

(1) 24-hour recall, children interviewed

Footnotes for Part Two

1) Head growth is virtually complete by middle childhood, so that the confounding effect of differential rates of maturation on head size would be minimal.

2) In this connection, the use of a configuration of "traits" to define eligibility in various social welfare programs is highly discriminatory at the level of "family."

3) One mother was deceased, in three cases the biological mothers could not be interviewed, and, occasionally, recall of the informant on a few questions was thought to be unreliable. However, the base figure (denominator) was never less than 25 in either group.

4) It is possible that preferences for junk may begin as adaptations to an economic situation. In urban areas, fifty cents' worth of junk goes farther to satiate hunger than fifty cents' worth of non-junk.

5) This does not preclude the possibility of medical supervision elsewhere. The distance between KUMC and the northeast area is 7 miles, and transportation is a major problem for many residents in the community.

6) Some of those in both groups who reported no increase said they actually ate less than usual.

7) Few women heeded the salt restriction, while the calorie restriction had more effect, because it was usually accompanied by threats of hospitalization if the diet was not adhered to.

8) Very few pregnancies were planned. However, in every case but two (both index), mothers expressed at least a sense of responsibility, and usually a positive attitude toward the pregnancy.

9) The three index children all fall below their median in terms of both current head circumference quotient and their developmental scores, whereas the control child ranks above the median on both parameters.

10) Some of this variation may be due to inaccurate recall.

11) Of the six infants for whom pre-mastication of food was documented (see Tables 2.8 and 2.9), the three index children are above the median in terms of both parameters, as is one control child, while the two other control children fall on opposite sides of the median for each of the parameters.

12) Weight in kilograms divided by height in centimeters times 100.

13) Arm circumferences and weight-height ratios were very highly correlated: +.924 for the index group and +.926 for the controls.

14) Data were gathered by the 24-hour recall method, children interviewed. For details, see the section on research methods.

15) See Appendix IV for conversion factors used in the calculation.

16) Allowing for the probability that the consumption of candy and other "junk", although reported in conscientious detail by each child, has been underreported, because the pursuit of "junk" is never-ending for most children, and consumption of it is sporadic throughout the day and so common as not to be remembered as easily as other foods.

17) Almost all "rides" (even relatives) expect some money, and our field researchers' single most appreciated gesture was their refusal ever to take money for transportation services.

18) Of the monthly money-recipients, 40 per cent reported that they shop differently when their money comes in, compared to less than 11 per cent of the families whose money comes in more frequently.

19) This is a painful example of how environmental patterns may be "there", but unrecognized, due to the failure of the observer-researcher to ask the right questions.

20) Wyandotte County, Kansas is at present only in the process of changing over to the food stamp program, so that most families were in a commodity distribution area, but several families, currently residing in Kansas City, Missouri (and therefore eligible for food stamps) were left in the sample if they were cognitively oriented toward the Kansas side, usually through kin ties, or a pattern of moving back and forth between Missouri and Kansas.

21) Variances of mean protein intakes were not homogeneous, so that differences between means could not be tested.

22) Cell sizes are small for the first-borne with three or more younger sibs, but the observed trend corroborates the findings of Chase and Martin (1970), that one of the factors associated with malnutrition was a large number of younger sibs. Only five children in the sample had three or more younger sibs, and data for them, treated separately, are: Mean height quotient, 90.2 $\pm$ 11.2; mean weight-height ratio, 20.5; mean protein intake, 48.9 gm.; mean calorie intake, 1705; mean current head circumference quotient, 57.6.

23) Moves necessitated by divorce were treated as "negative."

24) Questions 3 and 4 were scheduled some distance apart on the questionnaire, so that, hopefully, in answering question 4, mothers were minimally affected by what they had said in response to question 3.

25) The one anomaly is for children of mothers who said they prepare well-balanced meals and also said a "balanced diet" would keep a child healthy. This response, for those few who used it, probably implies a circularity and not superior knowledge of nutrition.

26) The latter possibility is unlikely, however, because mothers knew they were not being interviewed by dietitians or others who would place value judgments on their responses.

27) However, the opposite situation, i.e. where shoppers use supermarkets and general stores exclusively, does not necessarily imply a lack of motivation.

28) Bakeries and fish or meat markets were the most common shops patronized. The use of a milk man or an egg man was rare.

DISCUSSION

Significant correlations between head circumference by middle childhood and psychological test performance in the index group, and the absence of associations among the controls, suggest that smaller newborns may be at risk of impaired rates of mental development, when postnatal head growth is depressed.

It should be stressed that a number of index children showed very superior mental development by middle childhood. The point is that they also had large head circumferences, while those index children who performed poorly on psychological tests had smaller head circumferences, and, among control children, the two factors varied independently, as one would expect under conditions of relatively unhampered phenotypic expression of the two traits, in the absence of genetic linkage between head size and learning ability.

It would appear that, among the poor performers of the index group, something has suppressed the expression of genetic potential for both head size and mental development. Within the scope of this study, it is not possible to say more, but we submit that the role of nutrition is worthy of further consideration.

Part Two of this study has shown that there are ways, as yet largely untapped, to evaluate an "environment." It has been known for sometime that people of lower socioeconomic status are, as a group, smaller than those of upper socioeconomic status, so it is not surprising that economics is at the root of every parameter which was found to be associated with child growth. What is surprising is the lack of information on environmental variability <u>within</u> a ghetto, on the nature of the interaction between these micro-environments and growth, and on the contribution of policies of non-ghetto residents to the ghetto environment.

Most studies on poverty areas are based either on broad statistics or on case histories of pathological, "multi-problem" families, and it is easy to forget that most families in an urban ghetto are <u>not</u> pathological, although they must cope with the conditions that breed pathology. Many ghetto families live close to disaster -- only a minority go over the brink. Much more could be learned by comparing these groups with each other, and by examining them against the background of the larger society as it affects conditions in the ghetto.

RECOMMENDATIONS FOR FUTURE RESEARCH

In view of our findings, it would be desirable to replicate at least Part One of this study on a much larger scale. With Part One pared considerably, both in terms of the anthropometry and psychological testing schedules, a much larger sample could be handled economically, especially through a C and Y Project. All races could be included, and a large sample would permit a breakdown by sex.

The findings in Part Two suggest a host of future studies, focusing on some of the sub-areas of the environment which have emerged in our survey as relevant to child growth and nutrition. Among these topics are:

1) The role of the availability of private transportation on family decision-making, child growth and nutrition, and the impact of welfare regulations regarding automobile ownership as well as the rapid transit system serving the community.

2) Changes in the family money supply and changes in the food supply, both in terms of periodicity and long-term trends.

3) Residential stability and child growth, and the impact of housing and health codes, as well as urban renewal programs, on the total picture.

4) Nutritional knowledge vs. motivation vs. resource availability as factors in diet and child growth.

5) The child's role in his own diet.

Implicit in the above suggestions is the necessity of distinguishing analytically between those factors which are intrinsic to the group and those which are adaptations to conditions imposed on the group from without. This approach is described by Valentine (1968: 107-120), and could provide a framework for powerful models of the environment.

Recommendations for Action

The implication of our findings is that maternal and infant health and nutrition deserve the highest priority now. Many other studies are leading to the same conclusion (for a review, see Martin, 1973). No period in a child's life is more critical, for development of the biological base for his learning potential, than the gestational and early postnatal period of his life. For the central nervous system, all later remedial programs will be too late.

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APPENDIX I

Anthropometry: Basic Data[1] - Index Group

Sex	Newborn BW	Newborn BL	Newborn HC_o	CA	Current Ht.	Current HQ	Current Wt.	Current W/H	Current HC_1	Current Sk	Current AC	Current AC/CA
F	2683	48	35.0	9.754	132.7	91.4	28.6	21.6	52.2	8.0	17.7	1.81
F	2664	48	33.0	9.740	134.0	93.3	38.1	28.4	51.1	19.0	24.8	2.55
F	2500	47	32.5	9.641	139.9	104.6	29.8	21.3	50.0	11.5	20.3	2.11
F	2621	49	31.0	9.496	141.4	109.7	35.7	25.2	51.3	9.0	21.8	2.30
F	2978	51	35.0	9.435	138.2	102.5	24.5	17.7	52.8	9.0	17.7	1.88
F	2524	49	31.5	9.397	139.1	104.6	25.4	18.3	49.2	10.5	17.6	1.87
F	2725	49	33.0	8.954	130.1	95.9	30.2	23.2	52.6	23.0	22.6	2.52
F	2869	51	35.0	8.868	131.6	98.7	28.8	21.9	52.5	15.0	19.2	2.17
F	2710	47	32.5	8.770	116.4	70.5	18.6	16.0	47.8	9.2	16.5	1.88
F	2564	52	33.0	8.586	128.8	97.1	31.3	24.3	51.8	16.5	22.3	2.60
F	2691	49	33.0	8.283	131.8	106.6	25.2	19.1	51.2	11.5	17.5	2.11
F	2722	48	34.0	7.833	126.1	100.0	23.8	18.9	50.8	8.5	17.4	2.22
F	2615	49	30.5	7.751	124.1	95.7	30.2	24.3	50.1	23.5	22.3	2.88
F	2790	48	32.5	7.118	122.2	99.5	23.3	19.1	49.5	10.5	19.0	2.67
F	2759	49	33.0	6.991	123.2	103.7	22.2	18.0	50.9	10.0	17.2	2.46
M	2558	48	31.0	9.959	128.0	80.3	27.2	21.2	50.8	15.5	20.4	2.05
M	2675	47	32.5	9.762	132.9	91.3	28.5	21.4	52.2	14.0	20.4	2.09
M	2585	51	33.8	9.696	131.8	89.4	27.4	20.8	50.9	8.0	19.7	2.03
M	2774	51	33.0	9.159	128.8	88.3	24.0	18.6	51.9	4.0	18.9	2.06
M	2658	50	-	9.148	140.0	115.7	29.8	21.3	51.6	6.5	19.0	2.08
M	2665	49	32.0	9.055	134.7	104.0	31.3	23.2	51.4	15.0	20.6	2.27
M	2546	49	33.5	8.973	144.8	126.3	39.5	27.3	53.5	14.0	23.7	2.64
M	2610	50	32.0	8.784	136.6	111.9	25.5	18.7	51.1	4.0	16.3	1.86
M	2602	50	33.0	8.483	128.7	95.3	25.1	19.5	53.3	10.5	17.9	2.11
M	2644	48	34.0	8.175	125.7	92.8	26.8	21.3	53.2	9.0	19.5	2.39
M	2756	48	33.0	8.165	120.7	82.7	20.7	17.1	52.5	3.5	16.9	2.07
M	2729	51	33.0	7.301	127.0	107.3	27.4	21.6	51.6	18.0	20.9	2.86
M	2530	49	33.5	7.145	120.9	95.6	19.8	16.4	52.2	12.5	17.8	2.49

(1) For symbols, see key

APPENDIX I

Anthropometry: Basic Data[1] - Control Group

Sex	Newborn			CA	Current							
	BW	BL	HC_o		Ht.	HQ	Wt.	W/H	HC_1	Sk	AC	AC/CA
F	3351	50	34.5	9.061	125.7	85.5	24.5	19.5	52.7	8.0	17.9	1.98
F	3722	53	35.0	9.699	141.1	106.5	34.0	24.1	54.5	20.0	21.7	2.24
F	3518	54	35.0	9.126	129.7	93.1	28.0	21.6	53.3	10.0	19.7	2.16
F	4160	54	37.0	9.107	134.0	99.7	28.6	21.3	54.3	11.0	19.2	2.11
F	3223	50	34.0	8.928	137.1	105.5	29.7	21.7	52.4	8.0	20.4	2.28
F	3420	47	34.0	8.923	142.8	119.5	35.0	24.5	52.4	13.0	21.7	2.43
F	3549	50	34.2	9.655	132.2	91.5	29.5	22.3	50.5	11.0	20.1	2.08
F	3390	51	33.0	8.187	119.8	82.4	21.3	17.8	49.7	4.3	15.9	1.94
F	3230	49	34.0	8.145	120.2	82.9	23.8	19.8	48.8	12.5	19.7	2.42
F	3502	52	36.0	8.764	137.5	108.4	27.7	20.1	52.8	13.5	18.0	2.05
F	3339	50	35.5	8.967	129.2	94.8	23.8	18.4	53.2	8.0	19.0	2.12
F	3577	49	35.0	7.509	132.1	117.6	36.0	27.3	54.0	20.5	24.3	3.24
F	3568	51	32.5	7.786	126.4	101.7	22.5	17.8	50.7	6.3	18.5	2.38
F	4061	52	36.5	7.835	127.1	102.1	25.2	19.8	51.0	11.2	17.7	2.26
F	3411	48	34.0	7.025	126.6	112.7	36.5	28.8	56.5	28.0	25.0	3.56
M	3216	51	34.5	9.474	138.1	107.3	29.9	21.7	52.0	4.5	20.0	2.11
M	3184	47	34.5	.718	127.8	81.5	25.0	19.6	51.1	6.0	17.4	1.79
M	3547	51	37.0	8.784	138.7	117.6	30.0	21.6	53.6	10.0	19.3	2.20
M	3574	51	36.0	9.231	141.4	117.9	31.8	22.5	52.3	16.0	21.5	2.33
M	3374	51	36.0	9.721	133.4	93.4	27.4	20.5	52.6	6.5	19.9	2.05
M	3203	49	35.0	9.090	132.2	96.3	29.5	22.3	54.5	8.5	18.7	2.06
M	3285	49	34.5	9.660	128.2	82.8	23.5	18.3	51.8	5.0	17.4	1.80
M	3158	50	34.0	8.740	135.6	110.6	31.0	22.9	51.8	10.0	19.5	2.23
M	3723	49	36.5	8.301	136.1	117.5	33.5	24.6	52.6	15.5	22.1	2.66
M	3377	48	32.0	8.493	134.8	110.9	33.4	24.8	51.8	11.5	21.4	2.52
M	3254	48	33.5	8.005	132.4	110.3	28.6	21.6	53.5	6.0	19.8	2.47
M	3476	49	34.0	7.405	135.9	130.5	27.0	19.9	54.3	12.0	19.5	2.63
M	3512	50	36.0	7.460	133.8	122.9	27.2	20.3	55.4	6.0	19.1	2.56

(1) For symbols, see key

APPENDIX I

Key to Symbols

BW = Birthweight (gm.)
BL = Birth length (crown - heel) (cm.)
HC_o = Head circumference at birth (cm.)
CA^o = Chronological age at current measurement (yrs.)
Ht = Stature (cm.)
HQ = Height Quotient = $\frac{\text{Height Age}}{\text{Chronological Age}} \times 100$
Wt = Weight (kg.)
W/H = $\frac{\text{Weight (kg)}}{\text{Height (cm.)}} \times 100$
HC_1 = Current head circumference (cm.)
SK^1 = Skinfold thickness, triceps (mm.)
AC = Mid-arm circumference (cm.)
AC/CA = Ratio: $\frac{\text{Mid-arm circumference (cm.)}}{\text{Chronological age (yrs.)}}$

APPENDIX II

Developmental Testing: Basic Data[1]

Index

RQ	ITT_{TOT}	VK & HK	ID
62	93	91	111
88	102	101	103
96	99	100	100
62	93	90	97
96	103	104	103
96	102	104	114
100	105	107	112
114	102	102	106
95	95	94	90
95	107	110	114
94	102	104	114
83	103	103	107
61	91	89	62
106	95	91	70
106	107	107	115
92	102	102	105
104	103	103	111
54	96	95	108
95	101	101	105
100	98	96	97
86	96	93	89
127	105	106	109
114	98	100	112
150	107	110	114
106	103	103	101
189	107	110	114
82	103	103	104
100	88	88	93

1) For symbols, see key at end of Appendix II

APPENDIX II

Developmental Testing: Basic Data[1]

Control

RQ	ITT_{TOT}	VK & HK	ID
118	102	103	111
96	103	103	111
73	93	89	103
118	104	105	111
91	96	100	95
82	82	79	84
83	97	95	89
83	88	83	57
78	92	86	68
73	104	105	114
68	98	100	101
100	95	101	87
128	103	104	113
72	106	108	113
119	110	112	118
88	100	100	108
71	105	106	108
91	102	104	75
100	102	103	114
83	102	103	114
91	100	99	103
92	102	102	100
120	105	107	112
85	100	98	95
100	101	104	98
89	104	107	112
112	97	96	110
88	92	91	65

(1) For symbols, see key at end of Appendix II

APPENDIX III

Dietary Survey[1]: Basic Data

	Index		Controls	
	Protein (gm.)	Calories	Protein (gm.)	Calories
1	73.4	1853	67.5	1877
2	48.4	1672	96.9	1826
3	73.0	2835	47.7	1638
4	48.4	1215	40.6	1575
5	37.7	1359	41.2	1150
6	38.8	957	33.0	1630
7	58.0	1297	39.0	1260
8	65.7	1746	43.5	1393
9	33.5	1380	41.3	1361
10	59.0	1956	47.3	1343
11	88.1	2550	29.3	1201
12	64.0	1492	69.3	3257
13	45.9	1650		
14	19.0	647	37.0	1307
15	61.4	1445	63.9	1587
16	68.1	1928	40.7	1322
17			86.4	1992
18	33.0	740	34.5	1073
19	139.8	3053	67.7	1992
20	43.7	1455	24.0	1250
21	79.1	2122	49.1	946
22	55.0	1755	26.5	1095
23	46.0	1353	67.0	2172
24	46.2	1352	50.3	1214
25	140.2	2813	49.2	2529
26	78.8	1589	53.8	1876
27	46.7	2116	56.5	1268
28	47.0	1223	46.2	1554
$\bar{X}$	60.7	1687	50.0	1581

(1) 24-hour recall method, children interviewed

APPENDIX IV

Conversion factors used to estimate intake of selected nutrients in an average serving of food

	Calories	Protein
Bacon	90	5.0
Cold cuts	40	1.5
Hot dogs	138	5.6
Liver	98	11.2
Poultry	90	12.0
Pork or ham	192	4.8
Hamburgers	220	18.9
Meat loaf	220	18.9
Chili	168	10.0
Other beef	172	16.1
Fish	136	11.2
Cereal, dry	100	2.0
Cereal, cooked	65	2.5
Eggs	80	6.0
Pancakes	60	2.0
Cheese	65	4.0
Peanut butter	95	4.0
Greens	17	1.5
Dried beans	115	7.5
Jello	70	2.0
Ice cream	128	3.0
Soup	70	4.0
Pudding, etc.	142	4.5
Nuts	100	4.4
Sw. rolls, don.	125	1.0
Crackers	25	0.5
Cookies	50	1.0
Cake	120	2.0
Potato chips, etc.	115	1.0
Candy	50	0.0
Soda pop, etc.	115	1.0
Popsicles	70	0.0
Cornbread	125	3.0
Other bread	70	2.0
Butter, margar.	35	0.0
Milk	160	9.0
Sugar, etc.	40	0.0

	Calories	Protein
Juices		
Orange juice	120	2.0
Grape juice	135	1.0
Grapefruit	100	0.0
Drink & Punch		
Fruit punch	135	0.0
Hi "C"	135	0.0
Grape drink	165	0.0
Lemonade	110	0.0
Apple cider	120	0.0
Fruit		
Banana	100	1.0
Apple	70	0.0
Orange	65	1.0
Canned peaches	67	0.0
Mixed fruit cocktail	100	0.0
Watermelon	115	2.0
Potatoes, Irish		
Mashed	62	2.0
French fries	125	2.0
Tater tots	62	1.0
Potato buds	62	1.0
Potato salad	40	1.0
Potatoes, Sweet	155	2.0
Vegetables		
Corn	85	2.5
Peas	82	4.5
Lima Beans	95	6.5
Green beans	15	1.0
Spinach	22	2.5
Macaroni	215	8.5
Spaghetti	130	4.5
Rice	112	2.0
Noodles	100	3.5
Spanish Rice	112	2.0